A Housing Energy Management Program Report

Energy
Ontario

STATE OF THE ART REVIEW

OF SERVICES PROVIDED TO OWNERS

OF MULTI-UNIT RESIDENTIAL BUILDINGS

Undertaken jointly by the Ontario
Ministries of Municipal Affairs
and Housing and Energy under the
Housing Energy Management Program
(H.E.M.P.)

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1.0.0 EXECUTIVE SUMMARY

1.1.0 INTRODUCTION

In February, 1983, the Research and Development Section of the Ministry of Municipal Affairs and Housing with funds provided by the Ministry of Energy under the HEMP program commissioned ALLEN-DRERUP-WHITE LTD. to undertake a review of the availability of energy conservation expertise provided by the service sector to owners of multi-unit residential buildings.

The need for this work became apparent as concerns developed as a result of energy conservation initiatives undertaken by the Ministry in the multi-unit residential building sector regarding the quality of work provided by this sector's service industry. The service sector is characterized by a large number of small highly dispersed and non-organized contractors.

These contractors provide an important function in ensuring that the building structure and systems function properly. The questions that have been raised deal primarily with the effectiveness of the service sector. There are questions concerning the impact of adjustment and changes made by contractors to systems and the effect of one system on others.

For efficient long term operation of multi-unit residential buildings, owners require that all necessary services, to maintain the building structures and ensure the proper functioning of its internal systems, be readily available. The concerns of building owners revolve mainly around the technical competence of individuals in understanding the performance of systems be it a heating system, domestic hot water system, ventilation system, etc., and the interaction of these with one another.

1.2.0 SCOPE OF WORK

The project covered the broad spectrum of services provided to owners of multi-unit residential buildings that have an impact on energy consumption by the buildings systems. Five distinct tasks were undertaken in order to achieve a thorough review of the availability and regional distribution of service provided to building owners:

Task 1	A survey of multi-unit residential buildings, to obtain basic building system data, the level of system upgrade activity and the owners'/managers' perceptions of the service sector and energy conservation issues.
Task II	A survey of service contractors to obtain information regarding the range of services offered, qualifications of personnel and perceptions of the multi-unit residential field as a market opportunity for energy conservation.
Task III	Site inspections of a sample of ten multi-unit residential buildings to obtain in-depth interviews with the owner/manager, verify the information provided by the mail-out questionnaires, and to judge the quality of service provided.
Task IV	A review of extraneous support systems, including educational institutions, trade associations and manufacturers, for both building owners and service contractors.
Task V	Data analysis and assembly.

1.3.0 CONCLUSIONS

1.3.1 Building Owners and Property Managers

Management

Most buildings appear to be managed by crisis, not by objective i.e. there is a lack of planning. The responses to most questions support this; the lack of record keeping, the low level of scheduled servicing, the lack of water treatment systems, the high number of major replacements to domestic hot water systems etc.

The information on which decisions should be made was in many cases lacking. 71% had incomplete drawings, 80% had incomplete operating manuals, 25% had no formal method of tracking energy consumption or relied solely on periodic financial statements.

Energy

It was generally recognized by owners and property managers that energy is important to profitable building operation. Energy was, on average, considered to account for about 34% of operating expenses. However, only a small minority of building systems had been upgraded for energy conservation. A surprisingly large percentage, 37%, had an energy audit or study done, but only 18% had taken advantage of government assistance programs. The site inspections confirmed the general view that upgrades are performed when operational changes would have been more to the point and generally involve little or no cash outlay.

The service sector considered the majority of buildings to have the potential for cost-effective energy savings and characterized the owners as being generally concerned about energy conservation in their buildings but unwilling to make necessary financial investments.

Barriers

The major perceived barriers to the undertaking of energy conservation measures were rent review 60%, lack of capital 51% and lack of operating funds 49%. Unavailability or inadequacy of service organizations was considered of little or no importance.

Servicing

Service was never scheduled for various systems in a significant number of buildings, 10% to 48%, depending on the system. Where service was scheduled, it was generally for once a year, 30% to 49% again depending on the system. The most frequent contract type was time and material. When asked whether a total service contract would be of interest, 74% of the respondents said "no" and the most frequently given reasons were "present system satisfactory" and "would be too costly". The majority of respondents expressed satisfaction with the performance of both inhouse and outside services, though 48% felt there was a need for improvement in the education of building superintendents. The site inspections showed that the satisfaction is probably misplaced (see Site Conditions).

1.3.2 The Service Sector

Companies

The service sector was found to consist largely of small companies, with half employing 5 or fewer people. These companies in general serviced 3 or more different building systems, and had on staff 3 or fewer skilled tradespeople. The inference was that building systems were frequently being serviced by non-specialized personnel. The exceptions were building shell specialists and electrical contractors who did not tend to diversify to such a great extent as the other service organizations. Also these systems were omitted when nearly all systems were serviced.

Energy

Only half of the service companies reported that they actively sold or proposed energy conservation measures to multi-unit residential building managers, although the majority considered that buildings had the potential for cost-effective energy upgrades. The consultants suspect that conservation measures are not being consistently or effectively sold to multi-unit residential building owners who feel inhibited by rent review, and that a market opportunity exists in this area.

Work

Multi-unit residential building did not provide the bulk of work for most service contractors; more activity was reported to come from small-scale residential buildings, industrial and commercial projects. Of the multi-unit residential building work, very little was in the form of regular maintenance contracts, the majority being time and material. A company's reputation was considered of prime importance in obtaining multi-unit residential building work and price-cutting was cited as being the major difficulty. The most frequently cited co-ordination problem was time scheduling. Building owners in general considered the work provided by the service organizations to be satisfactory although there was a perceived need for better energy specialists and mechanical/electrical consultants. The majority of building owners stated that a directory of service organizations would be of use.

1.3.3 The Buildings

Systems

The majority, 65%, of the buildings were heated with gas central boilers, 25% were electrically heated. Only 24% of the buildings were air conditioned and of those 48% had individual window units.

There were many different ventilation systems, 48% included some form of central supply. 16% had no forced ventilation. Gas was the primary source for heating domestic hot water with 61% having a central gas boiler and 11% having individual gas water heaters.

1.3.3 The Buildings (cont'd)

The building shells were evenly divided between brick 49%, and concrete 47%. 48% of the buildings were single glazed.

Nearly all, 96%, had laundry rooms but heated garages or ramps were much less frequent with 57% having neither.

Nearly a third of the buildings had no emergency power. Incandescent lighting was common, with 63% using it indoors and 80% outdoors.

70% of the buildings had insulation on some pipes or ducts.

Time clocks were the most common automatic control, 67% of returned questionnaires. Only 56% of heated ramps were automatically controlled.

The majority, 57%, had never had air or water balancing performed. Water treatment systems were present for only 34% of central heating systems.

Upgrades

The most frequently given upgrade to any system was "total replacement" of the domestic hot water system, 38 cases. The motivating factor was not determined but a major replacement is an opportunity for improving the energy performance.

The most frequently given upgrade that potentially improves the energy performance was caulking and weatherstripping, 36 cases.

Improving the lighting was the third most frequently given upgrade, 34 cases, but may not be energy related.

Site Conditions

The site surveys showed that all buildings exhibited some form of service problem at the time of the site visit. For example, in most buildings the corridor supply units had plugged filters, and were set to maintain a warmer air temperature than necessary. Similarly, the domestic hot water temperature was maintained higher than normal in one half of the buildings. However in all buildings the boilers tested very high in combustion efficiency.

1.3.4 Support Services

Support services in the form of industry and building owner associations provide training programs, as do community colleges, technical high schools, other institutes of education, unions and individual manufacturers. The programs regarded as being most satisfactory from the service contractors point of view were trade associations and community colleges. The least satisfactory were the unions, with nearly half the respondents reporting dissatisfaction. The areas most in need of improvement were updating or upgrading the courses and hands-on training. The building owners required improved training for building superintendents and building managers. It would appear that in some instances courses existed but were being under-utilized either because the curriculum was not regarded as being fully relevant for employment in the service sector or because a course required full-time attendance where evening programmes might have been more appropriate. Graduates of community college programs were found to form a small percentage of the service sector work force although community colleges offered a variety of apparently relevant programs.

1.4.0 RECOMMENDATIONS

1.4.1 Education and Information

A key finding of the study was that appropriate information necessary to permit intelligent conservation decisions was often lacking. The following recommendations attempt to address this problem.

(i) Energy management information should be made readily available to owners; such information would include complete manuals and case study updates and could be disseminated at trade shows and conferences, at professional development seminars and through trade periodicals.

(ii) Owners' associations and community colleges should be encouraged and assisted to improve ongoing province-wide upgrading and training programs for building superintendents and property managers. Such programs should deal with energy conservation in the context of correct building system operation, procedures and records.

(iii) Trade Associations should be encouraged and assisted to set up province-wide training sessions on the assessment and effective marketing of conservation measures for multi-unit residential building systems.

(iv) Local Utilities should be encouraged to provide degree day data and other pertinent information for the billing period with each utility bill.

(v) A series of tenant awareness packages should be prepared, in conjunction with owners' associations to improve occupant energy habits.

(vi) A series of discussions with the various professional associations should be set up to determine a strategy for making available to multi-unit residential building owners and their contractors experienced energy consultants and mechanical/electrical consultants. The emphasis should be on trouble shooting and retrofit in existing buildings.

(vii) A provincial service sector directory aimed specifically at multi-unit residential building managers, should be produced.

1.4.2 Financing

Because financial barriers were seen by the majority of multi-unit residential building owners to be the major factor preventing the implementation of conservation measures, the consultant recommends that Ministry of Municipal Affairs and Housing be seen to recognize financing as a major issue.

1.4.2 Financing (cont'd)

(viii) As rent review was perceived as a major barrier, steps should be taken to dispel or lessen this perception, whether it is justified or not. If the perception is correct and if the rent review process is to be retained, an improved mechanism should be developed for permitting rent increases where such increments are required to cover capital costs of energy conservation, even though the subsequent operating costs may have been reduced. Also, incentive systems for those landlords who achieved energy savings in an approved manner should be investigated.

(ix) The possibility of providing loan incentives to building owners to assist them in financing energy conservation measures should be investigated.

(x) The private sector should be encouraged, wherever possible to implement creative financing packages for multi-unit residential building owners.

1.4.3 Future Research

Further research should be carried out and the case studies published to provide guidance to building managers when assessing the performance of their buildings. The emphasis should be on the practical rather than theoretical aspects.

(xi) An assessment should be made of conservation measures that have been employed in some of the sampled multi-unit residential buildings as to why they were employed, how the work was performed, and what savings/effects resulted.

(xii) A field survey of typical multi-unit residential building's should be undertaken which identifies energy usage, condition of the physical plant, and the potential for energy conservation upgrading particularly in conjunction with general servicing.

(xiii) Demonstration of thorough upgrading of typical multi-unit residential building's should be undertaken to test trial implementation procedures and to assess cost, savings, performance and practicality.

2.0.0 RESIDENTIAL APARTMENT SURVEY

2.1.0 OBJECTIVES

The questionnaire (Appendix 1) was designed to be building specific i.e. to deal with one individual building rather than many and to elicit three levels of information, namely:

1. Descriptive data on mechanical system types for each of the energy consuming systems and upgrade descriptions where system upgrades had been implemented.

2. Information regarding the performance of service organizations in maintaining, repairing and upgrading each system as perceived by the respondent.

3. Management approach and attitudes regarding energy consumption within the building and opportunities and barriers to implementing conservation measures.

In addition to the compilation of all original variables, some of the data was also broken down by area (Toronto Area, Southwest, Eastern and Northern Ontario) to determine if significant regional variations existed. Other cross tabulations were made by ownership type, building size and system type.

2.2.0 METHODOLOGY

A sixteen page questionnaire (Appendix 1) was developed and pretested on ten buildings in the Toronto area before being mailed to 1,795 apartments buildings across the Province.

Using a randomized circular systematic sampling procedure, the building addresses (for structures with a minimum of 20 units) were pulled from the C.M.H.C. apartment Universe Listings. The questionnaires were mailed-out on May 20, 1983. On June 23, postcard reminders were sent to those buildings which by then had not returned their questionnaires. The cut-off date for returned questionnaires was July 22, at which time 265 useable completed questionnaires were returned, coded and processed. However, questionnaires were being returned up to August 5. As of this date, a total of 427 returns had been received for a response rate of 23.8%. Accounting for those questionnaires that were returned as non-deliverable or ineligible, a final completion rate of 17.2% was achieved (see Table 2.1).

A general coding format was developed based on both the pretest results and initial questionnaire returns. During the coding process, however, a number of problems were encountered. These problems were related to:

- the number of open-ended questions in the questionnaire (which allowed for a very broad range of responses);
- the number of questions which did not foresee, or allow for, the possible combination of reponses given by respondents;
- the number of technical questions which were not always fully understood, or properly answered by the person completing the questionnaire.

After a number of questionnaires were initially coded, problems associated with the responses and the coding were noted. Appropriate changes were made to the coding format to allow for the range and diversity of responses in the survey. All questionnaires (including those previously coded) were recoded to reflect this format change.

TABLE 2.1

QUESTIONNAIRE RETURNS
RESIDENTIAL APARTMENT SURVEY

	Non Deliver-able	Ineligible	Refused	Request 2nd Quest.*	Processed Question-naires	Completed Question-naires
Toronto Area C.M.A. (180)	50	2	4	21 (9 returned)**	118	124
Southern Ontario (139)	53	1	-	4 (2 returned)	78	85
Eastern Ontario (52)	6	-	1	2 (2 returned)	40	45
Northern Ontario (56)	22	1	1	2 (0 returned)	29	32
Ontario (427)	131	4	6	29 (13 returned)	265	286

Mailed Out; 1,795
Response Rate: 427 or 23.8%
Completion Rate: (1,795 - 135) = 1,660 universe
286 of 1,660 or 17.2%

Note: Due to the original cut-off date of July 22, 1983, a total of 265 returned questionnaires were processed. Returns after this date were not included in the computer analysis due to the constraints.

* Due to postcard reminders a number of building managers/owners requested a questionnaire.

**Returned questionnaires have already been included in a "completed questionnaires" category.

2.3.0 RESULTS

The 265 completed questionnaires that were received before the cut-off date were processed.

TABLE 2.2 Responses by Area

Toronto Area	118
Southwest Ontario	78
Eastern Ontario	40
Northern Ontario	29

It was not possible to analyse all variables with respect to geographic areas, as there were frequently too few cases to be valid.

Caution - "completed" does not mean "100% completed". Various questions were not answered on different questionnaires. Sample size is the number who answered. When comparing 2 variables, the sample size is reduced to those who answered both questions.

For reasons of brevity and readability, some of the percentages and frequencies given in the text of this section are derived from tables and cross-tabulations not presented in the report but available on the Ministry printout. The specific occurrences have been marked.

Definitions

The following provides definitions of the terms which are used throughout the questionnaire.

SCHEDULED MAINTENANCE - regularly scheduled service including inspections, routine maintenance and minor repairs, e.g. cleaning filters, replacing washers.

BREAKDOWN REPAIRS - non-scheduled service such as repairing or replacing an item after a failure, e.g. a pump. A new boiler would be considered an upgrade.

UPGRADE - this is a one-time or an occasional action, e.g replacing the boiler, adding storm windows, non-scheduled 'tune-ups'.

INHOUSE SPECIALISTS - applies to larger organizations where there is a group of people who supply specialized skills to many buildings, but are directly employed by the building owner/manager (e.g. electrician, or plumber).

BUILDING SUPERINTENDENT/STAFF - people who are more or less responsible for this building, or cluster of buildings for routine maintenance.

INHOUSE STAFF - includes both inhouse specialists and building superintendent/staff.

2.3.1 Description of Buildings

The returned questionnaires showed that the buildings sampled covered a wide range in age and size.

TABLE 2.3 'Which year was the building completed (estimate if unknown)?' (Question A5)

Quantile	Year
100% Maximum	1982
75% Q3	1975
50% Median	1969
25% Q1	1963
0% Minimum	1902
Sample Size	254

TABLE 2.4 'How many storeys are above grade (count the ground floor as first storey)?' (Question A7)

Quantile	Storeys
100% Maximum	34
75% Q3	11
50% Median	6
25% Q1	3
0% Minimum	1
Sample Size	259

TABLE 2.5 'How many apartments are there in this building?' (Question A6)

Units	Responses
20- 40	71
41- 80	69
81-120	45
121-160	25
161-200	12
Over 200	39
Sample Size	261

2.3.2 Position of the Respondents

Although the questionnaires were addressed to the building superintendent or property manager, of the total 265 returns, 149 came from the manager or superintendent.

TABLE 2.6 Position of Respondent (Question A1)

Manager (Property/General)	124
Vice President	40
Owner	31
Superintendent	25
Maintenance Manager	9
Bookkeeper	9
Treasurer	5
Sample Size	243

2.3.3 Ownership and Building Management

The intent of the study was to focus on privately-owned buildings; but other ownership types were included. This was partly because of the make-up of the CMHC Universe and party by deliberate inclusion of some condominium buildings, which are normally difficult to access, to determine if there appeared to be any variations in response by ownership.

TABLE 2.7 'Which of the following terms best describes the ownership of the building?' (Question A3)

Private Sector, Rental	198
Co-operative	7
Non-profit	21
Public housing	21
Condominium	15
Sample Size	262

Private Sector, Rental was the most common in each of the regions, from 80% in Eastern Ontario to 66% in Northern Ontario. Condominiums and Co-ops appear to have limited existence outside of the Toronto Area.

TABLE 2.8 Ownership Types by Region

	Private	Co-op and Condo	Public and Non-Profit
Toronto Area	90	19	8
Southwest Ontario	57	2	17
Eastern Ontario	32	1	7
Northern Ontario	19	0	10
Sample Size	198	22	42

2.3.3 Ownership and Building Management (cont'd)

Although the majority 78%, of buildings were managed by the owners and their staff, over one fifth of the buildings were managed by property management companies.

TABLE 2.9 'Is this building managed by:' (Question A4)

Owner & staff	207
Outside organization	57
Sample Size	264

Outside organizations (property management companies) were the most popular in the Toronto area, 27% of buildings. The other 3 regions were fairly close, 18, 17.5, 14% for Southern, Eastern and Northern Ontario, respectively.*

Outside organizations were more popular with the Co-ops and Comdominiums.

TABLE 2.10 Per cent Managed by Outside Organizations

Private	22%	(43 of 197)
Condo & Co-op	45%	(10 of 22)
Public and Non-Profit	10%	(4 of 42)

2.3.4 Record Keeping and Management Practices

Although the majority of buildings had at least some drawings or operating manuals to assist service personnel, 51% answered "no none" to one or other question, while 30% answered "no none" to both.*

TABLE 2.11 'Do you have a set of "as is" structural, electrical and mechanical drawings for this building?' (Question A8)

'Do you have a set of operating manuals for all the systems in this building?' (Question A9)

	Yes All	Yes Some	No None	Sample Size
Drawings	77	86	101	264
Operating Manuals	52	98	113	263
Both	44	53	79	263

Energy consumption trends appear to be inadequately monitored in about 25% of the sample buildings with 36 respondents citing 'periodic financial statements' as being the only tracking mechanism and 28 checking 'not formally monitored'. Of the remaining respondents, 89 used 'utility records' only. Utility records will give the overall energy trends, for the building. However, it can be hard to identify the effect of, or the potential for, an energy conservation measure from utility records alone. This is particularly true where there is more than one system being served from one meter.

*Data from printout not shown.

2.3.4 Record Keeping and Management Practices (cont'd)

For example, when the energy used for space heating and domestic hot water are both measured with the same meter, cold weather will cause the same effect as dripping hot water taps. Inhouse meter reading is usually better than utility records as it shows some initiative on the part of building management. However, its usefulness depends on how the reading is done and what is done with the information.

TABLE 2.12 'How are energy consumption trends monitored in this building?' (Question C1)

	Only one Method	Total Count
Periodic financial statements	36	88
Utility records	89	147
Inhouse meter reading	29	56
Automatic data acquisition system	4	9
Outside energy management service	10	17
Not formally monitored	28	28
Other	0	3
Sample Size 260		

168 of the 260 respondents used one method only of tracking energy consumption; utility records being the most popular method.

Approximately half the buildings use utility records, regardless of type of ownership.

TABLE 2.13 Energy Consumption Tracking by Ownership Type

	Private	Co-op & Condo	Public & Non Profit	Sample Size
Periodic Financial Statements	67	11	9	87
Utility records	110	12	24	146
Inhouse meter reading	45	4	6	55
Automatic data acquisition	5	0	4	9
Outside energy mgmt. service	11	4	2	17
Not formally monitored/Other	25	1	5	31
Number of Buildings	198	22	42	

The majority of respondents rely on utility records, those outside of the Toronto area even more so. It was expected that in the Toronto area there would be a higher usage of automatic equipment, because of the easier access to it. However this did not materialize.

2.3.4 Record Keeping and Management Practices (cont'd)

TABLE 2.14 Energy Consumption Tracking by Region

	Toronto Area	South West	East	North	Sample Size
Periodic Financial Statements	40	25	15	8	88
Utility records	55	49	23	20	147
Inhouse meter reading	25	15	13	3	56
Automatic data acquisition	6	3	0	0	9
Outside energy mgmt. service	12	2	1	2	17
Not formally monitored/Other	18	3	6	4	31
Number of Buildings	118	78	40	29	

Lack of information is not however generally seen to be a barrier to the implementation of conservation measures; only 17% of respondents to question C.4 checked lack of information to be a 'very serious' or 'serious' problem, see 2.3.6 Barriers to Energy Conservation.

Energy Related Maintenance

Respondents were asked who provided energy-related maintenance. 37% was being done by onsite superintendent or staff, 34% by outside service organizations and the remainding 28% by inhouse specialist.

TABLE 2.15 'In general, how is energy-related maintenance handled?' (Question C5)

Mostly by onsite superintendent/staff	96
Mostly by inhouse specialists, with outside specialists as required	74
Mostly by outside service organizations	88
Other	4
Sample Size	262

In both Southwest and Eastern Ontario nearly half the service is provided by onsite staff. In the other two regions it is fairly evenly split between the 3 categories.

TABLE 2.16 Who Provides Maintenance by Region

	Onsite	Inhouse	Outside	Other	Sample Size
Toronto Area	36	34	45	2	117
Southwest	35	19	22	0	76
East	18	11	11	0	40
Northern	7	10	10	2	29

Over half the Co-ops and Condominiums reported using outside service organizations for the energy related maintenance. With the Public and Non-Profit group, nearly half used inhouse specialists. The private sector were fairly evenly divided, but with a slight preference for onsite staff.

2.3.4 Record Keeping and Management Practices (cont'd)

TABLE 2.17 Who Provides Maintenance by Ownership Type

	Onsite	Inhouse	Outside	Other	Sample Size
Private	76	53	63	1	195
Co-op & Condos	6	3	13	0	22
Public & Non-Profit	11	18	12	1	42

Of the 248 respondents who used outside service organizations for some portion of their service work, it would appear that 160 respondents have no regular maintenance contract with an outside contractor.* 7 reported there was no need for outside service organizations.

TABLE 2.18 'Which types of contract do you have for outside contractors?' (Question C8)

	Only method	Total Count
By upgrade project or one-time job	58	81
Full maintenance package	20	36
Preventive maintenance package	34	62
Time & Material	92	111
Sample Size 255		

When several organizations are involved in servicing one building there is a possibility of problems relating to co-ordination, overlapping jurisdiction and areas not covered by anyone. These problems can be avoided with a total service contract.

TABLE 2.19 'Would you be interested in a total service contract, i.e. one organization to look after all service work?' (Question C9)

No	189
Yes	68
Sample Size	256

The most frequently given reasons for not wanting such a service were 'the present system is satisfactory' and 'it would be too costly'. However the fact that 26% of respondents did want such a service indicates a potential market, and possibly some level of dissatisfaction with the existing system.

*Data from printout not shown.

2.3.5 The Importance of Energy Conservation

Energy consumption was recognised by 97% of respondents to be either 'very important' or 'important' to profitable building operation and was considered to account for approximately 34% of total operating costs.

TABLE 2.20 'How major a factor is energy consumption in the profitable operation of this building?' (Question C2)

Very important	158
Important	93
Minor importance	7
No importance	1
Sample Size	259

TABLE 2.21 'Energy forms approximately what percentage of total operating cost (excluding realty taxes and financing)?' (Question C3)

Mean 34% Range 4% - 85%

Even for cases where energy represents less than 20% of operating costs, it was considered a very important factor. Although, there was one respondent who considered it of minor importance while contributing over 80% of the operating costs.*

TABLE 2.22 Enery as a Percentage of Total Operating Costs by Importance of Energy to Profitable Operation

	0 - 20%	21 - 40%	41 - 60%	Over 60%
Very important	28	55	37	7
Important	24	26	16	3
Minor importance	3	0	3	1
No importance	0	0	0	0

Energy forms a greater percentage of operating costs in Northern Ontario than in the other regions as would be expected.

TABLE 2.23 Energy as a Percentage of Total Operating Costs by Region

	0 - 20%	21 - 40%	41 - 60%	Over 60%	Sample Size
Toronto Area	18	31	32	5	86
South West	23	26	8	2	59
East	10	18	6	1	35
North	4	7	10	3	24

*Data from printout not shown.

2.3.5 The Importance of Energy Conservation (cont'd)

Energy Studies

The majority of respondents reported that no energy studies had been performed on their building, however 37% of the respondents did report energy studies, of these the majority were satisfied, or felt that they were adequately performed. The table below shows who performed the studies and the level of satisfaction with the information. Some caution is required as some respondents had more than one study performed, whereas only one level of satisfaction could be reported. Consultants and Inhouse staff performed the majority of the studies, utilities were responsible for the fewest.

TABLE 2.24 'Have any energy studies been performed on this building?' (Question C11)

No	160
Yes	95
Sample Size	255

TABLE 2.25 Level of Satisfaction With Energy Study by Source

	Inhouse	Consultant	Contractor Supplier	Govt.Agency	Utility
Very satisfied	2	9	4	3	1
Satisfied	16	16	10	7	3
Adequate	14	7	6	6	2
Dissatisfied	0	3	2	1	0
Very Dissatisfied	0	1	0	1	0
Not specified	4	0	2	2	2
Sample Size	36	36	24	20	8

Energy audits were reported twice as frequently compared to the use of government assistance programs:

TABLE 2.26 'Has this building taken advantage of any government programs whether energy related or not?' (Question C12)

No	209
Yes	47
Sample Size	256

Comparing this response with C11, it is interesting that the "Yes" responses represent half the number of respondents who had energy audits done, indicating that follow-up remedial work would tend to be either owner-financed or not performed.

TABLE 2.27 Government Programs Utilised

	Count
CHIP	32
Gas conversion	9
M.M.A.H.	6
MOE.	3
SUMAC	3
New horizon	2

2.3.5 The Importance of Energy Conservation (cont'd)

The majority of building owners had not implemented major upgrades on the building systems. The system upgrade figures below should be treated cautiously because they include measures not necessarily directly related to energy conservation, for example building upgrades include basic waterproofing such as roof repairs.

TABLE 2.28 Major Upgrades by System

Upgrades to:	% 'Yes'	Yes	No	Sample Size
Building shell	33%	79	158	237
Domestic hot water	32%	77	161	238
Space heating system	29%	67	165	232
Electrical services	23%	53	174	227
Pipes & ducts	16%	32	168	200
Automatic controls	14%	31	185	216
Ventilation systems	9%	20	194	214

For more information on systems upgrades, refer to individual system sections.

Although good energy management was generally recognized to be important to profitable building operation, there was little indication from the data of a widespread attempt to implement conservation measures.

2.3.6 Barriers to Energy Conservation

Not surprisingly, the most frequently given response for an inability to improve the energy performance of the sample buildings was 'rent review'. With 60% of respondents classifying it as either 'very serious' or 'serious'. The 2% of respondents who considered rent review an advantage were all from the private rental sector but of the 32% who considered it to have no effect 15% were from the private sector, 6% were condominiums and the remaining 11% public ownership.* Lack of funds, both capital and operating, ranked next in importance with 51% and 49% respectively considering them 'very serious' or 'serious' problems.

TABLE 2.29 Barriers - Financial

	Very Serious or Serious
Rent Review	136 of 227
Lack of Capital Funds	113 of 219
Lack of Operating Cash	104 of 213

Of 161 private owners, 92 or 57% considered operating cash problems to be 'serious' or 'very serious', as compared to 7% of condominium owners and 31% of public housing managers.* Note that caution is needed in interpreting these percentages in that the sampling of the non-private sector ownership type is small and non-random.

*Data from printout not shown.

2.3.6 Barriers to Energy Conservation (cont'd)

Lack or inadequacy of service personnel and service organizations ranked fairly low on the list of perceived barriers, under 15% considered this a 'serious' or 'very serious' problem.

TABLE 2.30 Barriers - Staff and Service Organizations

	Very Serious or Serious
Lack of trained staff	29 of 195
Service organizations inadequate	18 of 194
Service organizations unavailable	7 of 189

Information barriers were considered only marginally more important.

TABLE 2.31 Barriers - Information

	Very Serious or Serious
Conservation not proven cost effective	32 of 189
Lack of information	34 of 203
Conflicting information	22 of 197

However 25% checked "resident problems" as 'very serious' or 'serious' which might be considered an information related barrier.

TABLE 2.32 'In your opinion, how serious are the following as barriers which prevent you from improving the energy performance of this building?' (Question C4)

	Very Serious	Serious	Minor Effect	No Effect	Advantage	Sample Size
Rent Review	108	28	14	72	5	227
Lack of Capital Funds	47	66	58	48	0	219
Lack of Operating Cash	43	61	58	51	0	213
Lack of Information	6	28	65	103	1	203
Conflicting Information	3	19	54	121	0	197
Conservation Not Provent Cost Effective	9	23	66	88	3	189
Building Already At Opt'mum Performance Level	6	18	64	76	20	184
Lack of Trained Staff, i.e. Training Required	2	27	45	118	3	195
Difficulties in Assessing Priorities	3	24	50	116	1	194
Service Organizations Inadequate	5	13	46	129	1	194
Service Organizations Unavailable	1	6	37	144	1	189
Resident Problems	24	26	50	101	1	202

2.3.6 Barriers to Energy Conservation (cont'd)

There were some minor variations, with geographic area. The only major difference was with rent review, 46% of the respondents from Northern Ontario said that it had no effect. By comparison, in the other regions, 48% to 54% consider it to be very serious. This may be due to the high proportion of public and non-profit housing, 10 of 29 buildings, in the northern group.*

It is interesting to compare the results of Question C4 with Question C13, in which respondents indicate a clear need for improved information and professional services.

Only 29 respondents rated "Lack of Trained Staff" as serious or very serious. However, many respondents wanted improvement in the education in all levels of building staff or management. Respondents also wanted improved professional consultants, especially energy, followed by electrical/mechanical consultants.

There was less dissatisfaction with the Service Contractors. Full maintenance contracts was the most frequently cited.

TABLE 2.33 'Which of the following areas need improvement?' (Question C13)

		Count
Educational:	Courses for building owners	66
	Courses for superintendents	128
	Courses for other building staff	36
	Accreditation Program for Property Managers	59
	Accreditation Program for Contractors	23
Professional Consultants:	Energy	81
	Electrical/mechanical	48
	Structural	16
	Architectural	20
	Comprehensive engineering	21
Service Contractor:	Comprehensive Property Management property management and all service work supplied by one organization	33
	Comprehensive Service Contractor: all service work excluding property management supplied by one organization	31
	Full Maintenance Contracts: flat rate for the complete maintenance of a specific system	45
	Energy Management Specialist contractor	35

*Data from printout not shown.

2.3.6 Barriers to Energy Conservation (cont'd)

Although very few respondents considered service organizations to be inadequate or unavailable, a clear majority felt that a directory of such organizations would be useful.

TABLE 2.34 'Would a directory of organizations which provide building service information be useful to you?' (Question C14)

Yes	172
No	51
Sample Size	223

2.3.7 Perceived Adequacy of Service Organizations & Personnel

Direct questions concerning the level of satisfaction with building servicing would appear to indicate that there are few problems in this area, see Table 2.35 below.

TABLE 2.35 'Are you generally satisfied with the service provided by inhouse staff?' (Question C6)

Very satisfied	76	(31%)
Satisfied	102	(41%)
Adequate	63	(26%)
Dissatisfied	6	(2%)
Very dissatisfied	0	(0%)
Sample Size	247	

A similar question was asked about the outside service organizations, but it was broken down by system. To compare with the inhouse service, averages were calculated by taking the sum of the responses in each level of satisfaction and dividing by the total applicable responses.

TABLE 2.36 'Are you satisfied with the service provided by outside service organizations ....' (Question D11)

	Maintenance	Upgrade
Very satisfied	621 (33%)	348 (33%)
Generally satisfied	1180 (63%)	644 (60%)
Dissatisfied	61 (3%)	57 (5%)
Very dissatisfied	23 (1%)	22 (2%)
Total applicable responses	1885	1071

Although it is impossible to draw any hard conclusions from this comparison because of the statistical inaccuracies involved, it would appear that in general the level of service is found by management to be equally satisfactory for both inhouse and outside organizations.

2.3.7 Perceived Adequacy of Service Organizations & Personnel (cont'd)

Responses to indirect questions indicated less satisfaction with service organizations.

TABLE 2.37 'Do you have problems with service people not understanding how building systems must work together?' (Question C10)

No	188
Yes	43
Don't know	30
Sample Size	261

16% of respondents perceived servicing problems with systems interaction whereas only 3% expressed dissatisfaction with service organizations.

2.3.8 Space Heating Systems

Source

In all, 171 (61%) of 255 buildings were heated with gas, 78 (25%) with electricity and only 6 with oil.

TABLE 2.38 'Which system type provides the main source of heat to the residential units?' (Question D1.1)

Central boiler:	Gas	165
	Electric	5
	Oil	6
Individual, Fan coil or furnace:	Gas	6
	Electric	6
	Heat pump	1
Individual, Not forced air:	Electric Baseboard	63
	Electric Radiant	3
Sample Size		255

2.3.8 Space Heating Systems (cont'd)

Servicing

Scheduled maintenance was performed once or twice a year in the majority 63% of the buildings, 19% of respondents reported 6 times or more and 10% indicated that no scheduled maintenance was being performed. Breakdown repair work was required between 1 to 5 times a year by 72% of respondents. 11% of respondents reported 6 times or more with one citing 60 times. 17% reported never.*

TABLE 2.39 Frequency of Scheduled Maintenance and Breakdown Repair for Space Heating Systems

Times per year	Scheduled Maintenance by Outside Service Organization	Scheduled Maintenance (Total)	Breakdown Repairs
Never	2	20	34
1	29	67	45
2	33	65	44
3-6	10	29	65
7-12	8	23	10
13 and up	0	1	4
Continuous	1	5	1
Sample Size	83	210	203

46% of respondents reported that regular maintenance was provided by outside service organizations and 32% by inhouse staff. 20% reported that regular maintenance was not applicable or not provided. More breakdown repairs were handled outside service organizations, 69%, with inhouse staff dealing with 15%: A further 15% considered breakdown repairs not applicable.

TABLE 2.40 Responsibility for Maintenance and Breakdown Repairs of Space Heating Systems

	(Scheduled) Maintenance Services	Breakdown Repairs
Not applicable	38	30
Outside service organization	100	140
Inhouse specialist	26	18
Building staff	44	13
Not serviced	6	1
Residents responsibility	2	1
Sample size	216	203

*Data from printout not shown.

2.3.8 Space Heating Systems (cont'd)

Of the two most common heating systems, gas central boiler and electric baseboard, the former was maintained by an outside service organization in 53% of the cases, whereas responsibility for electric baseboard maintenance was split between inside and outside staff, each 30%.

TABLE 2.41 Responsibility for Space Heating Maintenance by System Type

Scheduled maintenance	Gas Central Boiler	Electric Baseboard
Not applicable	15	15
Outside service organization	72	15
Inhouse specialist	17	6
Building staff	28	10
Not serviced	2	3
Resident responsibility	1	1
Sample Size	135	50

The majority of respondents were satisfied with the performance of the outside service organization. As might be expected, maintenance of the more complex gas central boiler systems caused some dissatisfaction.

TABLE 2.42 Level of Satisfaction with Maintenance by Space Heating System Type

Maintenance	All Systems	Gas Central Boiler	Electric Baseboard
Not applicable	43	17	18
Very satisfied	46	27	15
General satisfied	116	81	19
Dissatisfied	6	5	-
Very dissatisfied	3	3	-
Sample size	214	133	52

There is no significant difference in level of satisfaction with outside service organizations and the frequency of service. Of the 141 respondents who considered service applicable, 8 expressed dissatisfaction. 7 of these scheduled service once or twice a year, the other reported service occurred 'frequently'.*

*Data from printout not shown.

2.3.8 Space Heating Systems (cont'd)

System Upgrades

29% of 232 respondents reported that upgrades had been made to the heating system. These consisted of the following:

TABLE 2.43 Upgrades to Heating System Space

Conversion to gas	14
New controls	14
New heating plant	13
New turbulators/burners	5
New pumps	3
Heat reclaimer	1
Other**	21

2.3.9 Space Cooling System

Source

76% of the 257 respondents reported no cooling system. Of the 62 with cooling systems, 40% were central systems. Window units accounted for 48% of all cooling systems.

TABLE 2.44 'Which system type provides the main source of cooling to the residential units?' (Question D2.1)

None	195
Central Chiller	
Absorption	3
Reciprocating	3
Centrifugal	10
Don't know	9
Individual	
Window Unit	30
Fan Coil	5
Heat Pump	1
Don't know	1
Sample Size	257

6 respondents reported the source as central centrifugal and individual fan coil. These have been included in the former.*

Two thirds of cooling systems were found in buildings of 6 storeys or more.*

*Data from printout not shown.
**'Other' included overhaul, water treatment, and minor alterations.

2.3.9 Space Cooling Systems (cont'd)

Servicing

It is interesting that 47% of respondents never schedule maintenance on the cooling system while 60% never repair the system. It was not determined if these responses were from the same buildings.

TABLE 2.45 Frequency of Scheduled Maintenance and Breakdown Repairs For Space Cooling Systems

Time per year	Scheduled Maintenance (Total)	Breakdown Repairs
Never	34	32
1	11	7
2	11	5
3-6	10	7
7-12	6	0
13 and up	0	2
Continuous	0	0
Sample Size	72	53

Outside service organizations provide the majority of the regular maintenance and breakdown repairs.

TABLE 2.46 Responsibility for Maintenance and Breakdown Repairs of Space Cooling Systems

	(Scheduled) Maintenance Service	Breakdown Repairs
Not applicable	124	113
Outside Service Organization	36	38
Inhouse Specialist	3	3
Building Staff	11	7
Not serviced	4	3
Residents Responsibility	3	2
Sample Size	181	166

92% of the respondents were generally or very satisfied with the maintenance provided by the outside service organization.

2.3.9 Space Cooling System (cont'd)

System Upgrades

4 respondents reported upgrades to the cooling system, of which 2 were installing heat pumps. However 29 respondents reported a level of satisfaction with an upgrade.

2.3.10 Ventilation System

Source

There were a wide variety of responses, including some unexpected combinations.

16% reported no forced ventilation i.e. no fans. There were no instances of individual heat recovery equipment and only 3 of central heat recovery.

42 reported only exhaust fans and 41 reported only supply fans.

Central supply fans were present in 48% of the buildings. This increases to 66% if packaged roofing and heat recovery units are included.

TABLE 2.47 'Which system type provides ventilation to the residential units?' (Question D3.1)

	Sole Source	In Combination With Individual System(s)	In Combination With Central System(s)	Total Count
No Forced Ventilation	41	--	--	41
Individual				
Exhaust	17	2	50	69
Supply	1	2	--	3
Heat Recovery	--	--	--	--
Central				
Exhaust	25	--	49	74
Supply	40	33	50	122
Packaged Roof Top	22	18	20	59
Heat Recovery	2	--	1	3
Sample Size 253				

2.3.10 Ventilation System (cont'd)

Servicing

For this system, there appears to be genuine time scheduling, for service work; 20 cases of monthly, 10 of bimonthly and 30 of quarterly.*

TABLE 2.48 Frequency of Scheduled Maintenance and Breakdown Repairs for Ventilation Systems

Times serviced per year	Scheduled Maintenance by Outside Service Organization	Scheduled Maintenance (Total)	Breakdown Repairs
Never	1	25	43
1	16	36	35
2	14	37	37
3-6	27	45	25
7-12	6	21	4
13 and up	-	2	-
continuous	-	1	-
Sample Size	64	167	144

Nearly 40% of respondents reported scheduled maintenance was performed by outside service organizations. 20% reported that it was not done or not applicable. These changed to 55% and 17% respectively for the breakdown repairs.

TABLE 2.49 Responsibility for Maintenance and Breakdown Repairs of Ventilation Systems

	(Scheduled) Maintenance Service	Breakdown Repairs
Not applicable	37	31
Outside Service Organization	85	113
Inhouse Specialist	24	26
Building Staff	61	31
Not serviced	8	3
Residents Responsibility	1	-
Sample Size	216	204

The majority of respondents were satisfied with the performance of the outside service organizations. Excluding the "not applicable" replies, 65% were generally satisfied and 31% were very satisfied with the maintenance service. 6 respondents reported dissatisfaction for maintenance, 2 for upgrades.

*Data from printout not shown

2.3.10 Ventilation System (cont'd)

TABLE 2.50 Level of Satisfaction with the Maintenance of Ventilation Systems

	Maintenance	Upgrade
Not applicable	43	65
Very satisfied	47	22
Generally satisfied	100	55
Dissatisfied	5	1
Very dissatisfied	1	1
Sample Size	196	144

System Upgrades

21 respondents (10%) reported upgrades had been made to the ventilation system. Half of these were installing timeclocks.

TABLE 2.51 Upgrades to Ventilation System

Timeclock	10
New motors/belts	7
Repair rooftop unit	2
Total replacement	1
New fans	1
Conversion of ignition system	1

2.3.11 Domestic Hot Water System

Source

61% of the buildings supply the domestic hot water from a central gas boiler. 21% have individual water heaters of which approximately half are gas fired.

TABLE 2.52 'Which system type provides hot tap water to the residential units?' (Question D4.1)

Central	
Heat exchanger from space heating boiler	14
Oil boiler	6
Gas boiler	158
Electric boiler	27
Individual	
Gas water heater	29
Electric water heater	26
Sample Size	260

2.3.11 Domestic Hot Water Systems (cont'd)

83% of buildings of 6 or more storeys have a central system. This drops to 74% for buildings of 1 to 5 storeys.*

Servicing

Scheduled maintenance was performed once or twice a year in the majority of buildings, 40%, 22% respectively. 17% of respondents reported never.

A similar pattern emerged with the breakdown repairs; once or twice a year accounts for 53% and never for 29%.

Of the scheduled maintenance performed by outside service organizations, 51% are for once a year.

TABLE 2.53 Frequency of Scheduled Maintenance and Breakdown Repairs for Domestic Hot Water Systems

Time per year	Scheduled Maintenance by Service Organization	Scheduled Maintenance (total)	Breakdown Repairs
Never	12	36	55
1	56	83	56
2	24	46	43
3-6	13	24	30
7-12	4	17	3
13 and up	-	0	1
Continuous	-	1	0
Sample Size	109	207	188

60% of respondents reported that regularly scheduled maintenance is performed by outside organizations while 32% reported that it is performed by inhouse staff. Breakdown repairs were reported to be handled predominantly by outside service organizations 82%, with inhouse staff dealing with 16%.

TABLE 2.54 Responsibility for Maintenance and Breakdown Repairs for Domestic Hot Water Systems

	Maintenance Service	Breakdown Repairs
Not applicable	11	3
Outside Service Organization	136	178
Inhouse Specialist	25	21
Building Staff	48	14
Not serviced	3	1
Residents Responsibility	2	1
Sample Size	225	218

*Data from printout not shown.

2.3.11 Domestic Hot Water System (cont'd)

The majority of respondents were satisfied with the service provided by outside service organizations. Of the 181 respondents, 6 reported they were dissatisfied with the maintenance service, all with gas systems. Of these 4 are in the once-a-year category. The one who reported frequent maintenance was very dissatisfied.*

System Upgrades

77 (32%) respondents reported that the domestic hot water system had been upgraded, though only 74 reported on the nature of the upgrade. 7 reported two upgrades.

TABLE 2.55 Upgrades to Domestic Hot Water Systems

Summer system	6
Total replacement	38
Replaced or added hot water tanks	23
Major plumbing upgrade	5
Heat exchanger/coil	4
Controls, timers	3
Insulation	1
Solar system	1
Sample Size	81

The majority were satisfied with upgrade service, 6 of the 113 respondents reported dissatisfaction. Approximately 1/3 of central systems were upgraded whereas only 14% of individual systems were. 4 out of 6 oil fired boilers were upgraded.*

2.3.12 Building Shell/Envelope

The type of building construction was fairly evenly divided between concrete and brick. Woodframe accounted for only 8 buildings, and as expected are all 5 storeys or less.

TABLE 2.56 'Which of the following terms best described the type of construction?' (Question D5.1)

Type	Total	1-5 storeys	6 and over
Concrete and Curtain wall	69	26	41
Concrete and Infill panel	44	6	37
Woodframe	8	8	-
Solid brick + Block and Brick	119	55	46
Steel frame with masonry	2	1	1
Sample Size	242	102	135

*Data from printout not shown.

2.3.12 Building Shell/Type cont'd)

Both the pretest and the on-site inspections showed that the responses were not reliable in this area, although nobody checked the "don't know" box.

Approximately half the buildings are double glazed (51%). Only one reported triple glazing.*

Servicing

48% of respondents reported that regular maintenance was never scheduled. 37.5% reported it was scheduled once or twice a year. There does not appear to be much difference with building type.

TABLE 2.57 Frequency of Scheduled Maintenance by Building Type

Scheduled Maintenance Times per year	All	Concrete	Brick
0	69	22	36
1	37	19	12
2	17	4	12
3-6	15	9	5
10-12	5	3	2
Continuous	1	0	1
Sample Size	144	62	67

Breakdown repairs showed similar results:

TABLE 2.58 Frequency of Breakdown Repairs by Building Type

Breakdown Repairs Times per year	All	Concrete	Brick
0	65	25	31
1	16	8	8
2	19	9	9
3-6	21	11	9
10-12	8	3	5
13-40	5	2	1
Continuous	1	0	1
Sample Size	135	58	64

*Data from printout not shown.

2.3.12 Building Shell/Envelope (cont'd)

49% of respondents reported that the regular maintenance to the building shell is provided by outside service organizations. 16% of respondents reported that regular maintenance was not done or not applicable. Breakdown repairs were predominantly handled by outside service organizations 68% with inhouse staff dealing with 20%.

TABLE 2.59 Responsibility for Maintenance and Breakdown Repairs of Building Shell/Envelope

	Maintenance Service	Breakdown Repairs
Not applicable	22	19
Outside Service Organization	101	140
Inhouse specialist	24	17
Building Staff	47	24
Not Serviced	12	5
Residents Responsibility	1	1
Sample Size	207	206

Regular service is marginally more likely to be provided by outside service organizations on brick buildings than on concrete ones.

TABLE 2.60 Responsibility for Maintenance by Building Type

	Concrete	Brick
Not applicable	8	10
Outside Service Organization	41	53
Inhouse specialist	9	11
Building Staff	26	16
Not Serviced	6	4
Residents Responsibility	0	0
Sample Size	90	94

The majority of respondents were satisfied with the performance of the outside service organizations; excluding the "not applicable" replies 93% of 164 for maintenance. 90% of 107 for upgrades. However second to laundry room service, this area had the highest number of dissatisfied respondents, 12, for each of maintenance and upgrades. The dissatisfaction was predominantly with concrete buildings.

TABLE 2.61 Level of Satisfaction with Maintenance of Building Shell/Envelope by Building Type

	All Building Types	Concrete	Brick
Not applicable	35	17	15
Very Satisfied	49	24	22
Generally Satisfied	103	44	47
Dissatisfied	9	7	2
Very Dissatisfied	3	2	0
Sample Size	199	94	86

2.3.12 Building Shell/Envelope (cont'd)

TABLE 2.62 Level of Satisfaction with the Upgrades to the Building Shell/Envelope by Building Type

	All Building Types	Concrete	Brick
Not applicable	48	24	21
Very Satisfied	32	13	18
Generally Satisfied	62	22	28
Dissatisfied	8	4	4
Very Dissatisfied	5	3	0
Sample Size	155	66	71

System Upgrades

One third of the respondents reported that the building shell had been upgraded, 79 of 237. 18 reported 2 upgrades. 3 did not report the nature of the upgrade. The most frequent upgrade was caulking and weatherstripping.*

TABLE 2.63 Upgrades to Building Shell/Envelope

Caulking & Weatherstripping	36
Reinsulate	4
Roof repaired or replaced	22
Exterior walls, e.g. siding, bricks, pointing	18
New windows	12
New window sills or frames	2
Sample Size	94

2.3.13 Electrical System

Source

32% reported that there was no emergency power system in the building. 4 respondents reported having both emergency generator and battery systems.

Incandescent lighting was in general use despite its inefficiency. 63% of respondents reported using incandescent lighting indoors and 80% were using it outdoors.

*Data from printout not shown.

2.3.13 Electrical System (cont'd)

TABLE 2.64 'Please identify which of the following exist in this building?' (Question D6.1)

		Sole Source	Total Count
Emergency Power:	Emergency Generator	56	60
	Batteries	98	102
	None	75	75
Sample Size	235		
Interior Lighting:	Incandescent	93	157
	Fluorescent	82	147
	High Intensity Discharge	3	4
	None	5	5
Sample Size	248		
Exterior Lighting:	Incandescent	162	193
	Fluorescent	15	31
	High Intensity Discharge	23	46
	None	5	5
Sample Size	240		

Servicing

39% of respondents reported that regular maintenance was never scheduled. Only 24% reported 3 times per year or more.

TABLE 2.65 Frequency of Scheduled Maintenance and Breakdown Repairs for the Electrical System

Times per Year	Scheduled Maintenance	Breakdown Repairs
Never	63	54
1	38	28
2	22	21
3-6	19	37
7-12	13	10
13 and up	6	2
Continuous	1	0
Sample Size	162	152

2.3.13 Electrical System (cont'd)

56% of responses for scheduled maintenance and 80% for breakdown repairs reported the service was performed by outside service organizations. This is higher than for other systems and may be due to the special skills required for working on electrical systems. Very few respondents considered service as unnecessary.

TABLE 2.66 Responsibility for Maintenance and Breakdown Repairs for the Electrical System

	Scheduled Maintenance	Breakdown Repairs
Not applicable	9	2
Outside Service Organization	123	178
Inhouse specialist	24	18
Building Staff	51	21
Not Serviced	10	2
Residents Responsibility	1	1
Sample Size	218	222

The performance of the outside service organization in this area generated the highest number, and highest percentage, of very satisfied responses.

TABLE 2.67 Level of Satisfaction with the Maintenance of the Electrical System

	Maintenance	Upgrade
Not Applicable	15	37
Very satisfied	81	50
Generally satisfied	119	67
Dissatisfied	2	2
Very dissatisfied	1	1
Sample Size	218	157

System Upgrades

Only 23% of respondents reported that upgrades had been made to the electrical system. The most common upgrade was improving the lighting. Considering the high quantity of incandescent lighting, there are many more buildings that should be upgrading the lighting systems.

TABLE 2.68 Upgrades to the Electrical System

Improve lighting	34
New transformer or batteries	6
Rewiring	7
Automatic controls	5
Fire alarm system	3
Sample Size	48

2.3.14 Automatic Controls

Although the automatic controls listed in the questionnaire are not strictly necessary, it is very difficult to operate a building efficiently without them. Simple controls were more prevalent than control systems. 182 respondents reported time clocks while only 10 reported a central control system. Traditional areas are the most automated, perhaps showing residential buildings are slow to implement innovations in this area.

It appears that a third of the buildings have no automatic controls. Excluding time clocks, half (or more) of the building systems are not automated.

TABLE 2.69 'Please check off each of the following automatic controls which can be found in this building?' (Question D7.1)

Timeclock	182	67% of 265 returned questionnaires
Indoor/Outdoor control of heating water	91	52% of 176 central boilers
Automatic Start or stopping by outdoor air temperature	71	40% of 176 central boilers 37% of 192 central ventilation systems
Photo cell	58	25% of 235 with exterior lighting
Electrical Demand Limiter	12	5% of 265 returned questionnaires
Automatic control of snowmelting or ramp heater	40	56% of 72 heated ramps
Automatic control of water treatment system	23	38% of 60 water treatment systems
Central Alarm or Monitoring System (exclude Fire)	30	11% of 265 returned questionnaires
Central Control System	10	4% of 265 returned questionnaires 12% of the 82 buildings with over 80 units* 7% of the 146 buildings with 6 or more storeys*

*Data from printout not shown.

2.3.14 Automatic Controls (cont'd)

Servicing

51% of respondents reported that regular maintenance is scheduled once or twice a year. 29% reported that it is never scheduled. Nearly half reported no breakdown repairs.

TABLES 2.70 Frequency of Scheduled Maintenance and Breakdown Repairs for Automatic Controls

Times per Year	Scheduled Maintenance	Breakdown Repairs
Never	49	70
1	54	37
2	32	14
3-6	20	21
7-12	12	2
13 and up	0	0
Continuous	2	0
Sample Size	169	144

Two thirds of the regular service performed, is handled by outside service organizations. This increases to 82% of the breakdown repairs.

TABLE 2.71 Responsibility for Maintenance and Breakdown Repairs for Automatic Controls

	Scheduled Maintenance	Breakdown Repairs
Not applicable	26	18
Outside Service Organization	109	143
Inhouse specialist	19	17
Building Staff	38	14
Not Serviced	14	8
Residents Responsibility	0	0
Sample Size	206	200

The majority of the respondents are satisfied with the performance of the outside service organizations. This area has one of the highest proportions of Very Satisfied responses, 30%, but also is on the high side with Dissatisfied responses, 6%.

TABLE 2.72 Level of Satisfaction with the Maintenance of Automatic Controls

	Maintenance	Upgrade
Not Applicable	36	57
Very satisfied	48	25
Generally satisfied	101	59
Dissatisfied	7	3
Very dissatisfied	3	3
Sample Size	195	147

2.3.14 Automatic Controls (cont'd)

System Upgrades

Of 216 respondents, 14% reported upgrades have been made to the automatic controls. The majority were for the heating controls.

TABLE 2.73 Upgrades to Automatic Controls

New Heating Controls	18
Time Clocks	6
Remote Monitoring Systems	3
Air Temperature Controls	2
Fire Alarm and Communications	4

2.3.15 Water Treatment

60 respondents (25%) reported water treatment systems were present.* Water treatment is highly recommended as preventive maintenance on central heating or cooling systems.

There are 176 central boilers for heating and 25 central cooling systems, which are probably in the same buildings as the central heating. This infers that only 34% of the central systems have water treatment systems, and only 13% have automatic water treatment systems.

Over half the servicing is performed by outside service organizations. Excluding the "not applicable" responses, 10% report that the system is not serviced.

TABLE 2.74 Responsibility for Maintenance and Breakdown Repairs for Water Treatment Systems

	Scheduled Maintenance	Breakdown Repairs
Not applicable	104	99
Outside Service Organization	41	41
Inhouse specialist	15	12
Building Staff	22	14
Not Serviced	11	7
Residents Responsibility	0	0
Sample Size	193	173

The majority of respondents are satisfied with the performance of the outside service organizations. Note that there are 73 opinions on the quality of the maintenance while only 41 reported having systems.

*Data from printout not shown.

2.3.15 Water Treatment (cont'd)

TABLE 2.75 Level of Satisfaction with the Maintenance of Water Treatment Systems

	Maintenance	Upgrade
Not Applicable	110	105
Very satisfied	18	10
Generally satisfied	53	24
Dissatisfied	0	4
Very dissatisfied	2	1
Sample Size	183	144

Upgrades are providing a high proportion of dissatisfaction, 13% of the "applicable" responses.*

2.3.16 Laundry Room Services

250 or 96% of respondents reported laundry rooms in the building. 77 or 33% reported upgrades had been made. 63% of the regular maintenance is provided by outside service organizations. This increases to 77% for breakdown repairs.*

The not applicable and not serviced categories only accounted for 8% and 5% of scheduled maintenance and breakdown repairs respectively. This very low proportion may be a reflection that failures in the laundry room cause more attention.

The majority of respondents are satisfied with the quality of service provided by outside service organizations. However the maintenance of the Laundry Room Services did generate the highest number of dissatisfied responses 17, but as this area has the highest number of respondents, the dissatisfied are only 7% of the total.

TABLE 2.76 Level of Satisfaction with the Maintenance of Laundry Room Services

	Maintenance	Upgrade
Not Applicable	20	43
Very satisfied	72	32
Generally satisfied	119	69
Dissatisfied	14	6
Very dissatisfied	3	3
Sample Size	228	153

*Data from printout not shown.

2.3.17 Pipe and Duct Insulation

74 or 30% reported that pipes and ducts were NOT insulated.

32 or 16% reported the insulation had been upgraded. Insulating the domestic hot water system accounted for 25 of the 27 upgrades described. There was no mention of insulating heating, cooling or ventilation systems.*

Again outside service organizations provide the majority of the service.

TABLE 2.77 Responsibility for Maintenance and Breakdown Repairs of Pipe and Duct Insulation

	Scheduled Maintenance	Breakdown Repairs
Not applicable	51	48
Outside Service Organization	80	99
Inhouse specialist	17	16
Building Staff	29	16
Not Serviced	21	14
Residents Responsibility	0	0
Sample Size	198	193

The majority are satisfied with the service provided by outside service organizations. 4 to 5% reported dissatisfaction.

TABLE 2.78 Level of Satisfaction with the Maintenance of Pipe and Duct Insulation

	Maintenance	Upgrade
Not Applicable	75	79
Very satisfied	37	22
Generally satisfied	70	39
Dissatisfied	4	6
Very dissatisfied	1	1
Sample Size	187	147

*Data from printout not shown.

2.3.18 General Plumbing

74 or 34% reported that upgrades had been made. The upgrades described were:

TABLE 2.79 Upgrades to the General Plumbing

Conversion of galvanized to copper	29
Rebuilding taps and valves	20
General replace or improvements	27
Low flow showerheads	2

The scheduled maintenance is evenly split between the inhouse staff and outside service organizations, though 75% of the breakdown repairs are performed by outside service organizations. General plumbing receives the highest involvement from building staff. It also has the least not applicable responses.

TABLE 2.80 Responsibility for Maintenance and Breakdown Repairs for the General Plumbing

	Scheduled Maintenance	Breakdown Repairs
Not applicable	6	0
Outside Service Organization	115	173
Inhouse specialist	36	28
Building Staff	63	30
Not Serviced	6	1
Sample Size	226	232

The majority are satisfied with outside service organizations. Upgrades caused more dissatisfaction than maintenance.

TABLE 2.81 Level of Satisfaction with the Maintenance of the General Plumbing

	Maintenance	Upgrade
Not applicable	12	42
Very satisfied	78	45
Generally satisfied	131	66
Dissatisfied	4	8
Very dissatisfied	1	1
Sample Size	226	162

2.3.19 Air and Water Balancing

Balancing is required periodically on all central systems to ensure the correct quantity is delivered to each end location.

TABLE 2.82 'How often is balancing done on ventilation, central heating or cooling systems?' (Question D8.5)

Never	97
Regularly:	
every year	33
every 2 or 3 years	8
Once:	
0-4 years ago	25
5 or more years ago	8
Sample Size	171

Of the 97 responses of "never", 67 were from buildings with central heating systems and 60 with central ventilation systems. For comparison, there were 176 buildings with central heating systems and 233 with central ventilation. However it does not follow that the remaining central systems were balanced. There were 94 non-replies to the balancing question.*

65 respondents reported using outside service organizations while 28 used inhouse staff. This includes 6 who used a combination of both.*

The majority were satisfied with the outside service organizations. Excluding the "not applicable" replies, 3 of 84 were dissatisfied with maintenance and 5 of 44 were dissatisfied with upgrades.*

2.3.20 Garage

Of the 244 respondents, 57% reported having neither heated garage nor ramp heaters. 13% reported having both.

TABLE 2.83 'Do you have a heated garage and/or ramp heater?' (Question D8.6)

Both	31	
Heated garage	33	(64 Total)
Ramp heater	41	(72 Total)
Neither	139	
Sample Size	244	

*Data from printout not shown.

2.3.20 Garage (cont'd)

16 respondents reported having upgraded the garage. The upgrades described were:

TABLE 2.84 Upgrades to the Garage

Structural repairs	8
Electrical	4
Added space heater	2
Hour counter ramp	2
Covered garage ramp	1
Controls	1

Regular maintenance is provided mainly by inhouse staff. Excluding the not applicables and not serviced, inhouse staff provide 2/3 of regular maintenance but only 1/3 of breakdown repairs.

TABLE 2.85 Responsibility for Maintenance and Breakdown Repairs for the Garage

	Scheduled Maintenance	Breakdown Repairs
Not applicable	84	70
Outside Service Organization	31	68
Inhouse specialist	22	17
Building Staff	42	17
Not Serviced	10	8
Residents Responsibility	1	0
Sample Size	190	180

The majority of respondents were satisfied with the outside service organizations. Only 2 out of 84 expressed dissatisfaction with maintenance. 3 of 45 were dissatisfied with upgrades.

2.3.21 Other Energy Consuming Systems

19 respondents reported that there were other energy consuming systems in the building. These were described as:

TABLE 2.86 Other Energy Consuming Systems

Sauna	11
Swimming pool	7
Elevators	4
Eave heater	1
Automatic garage door	1

No upgrades were reported.

2.3.22 A last question was asked to determine the specific areas causing dissatisfaction.

TABLE 2.87 'Are there specific areas which you are dissatisfied with the service provided to the building?' (Question E1)

Yes	38
No	162
Sample Size	200

The most common complaint was related to competence of service organizations. There were 20 responses of:

> "service organizations appear to be non-efficient, non-professional, very expensive and indifferent."

9 respondents cited difficulty in finding competent trained employees to service building systems, with another 5 giving lack of information or training.

The cost of improving energy efficiency including hiring the energy experts and outside contractors, dissatisfied 18 respondents.

As expected, rent review is causing dissatisfaction, 14 responses. However, bulk metering drew 16 responses, for example:

> "Tenants should be forced to pay their own energy (hydro) bills"

> "Install meters for individual tenants: would allow owner to convert to energy-efficient systems, i.e. lower costs for landlord and tenants would become more careful with consumption"

> "energy conservation is NIL in apartment buildings when landlord pays the utility bills."

The utilities drew several comments from "hydro bills too high" to "meter reading practice of utility company makes comparisons impossible year to year".

There was one positive comment "degree day information on gas bills would be a big help".

3.0.0 THE SERVICE CONTRACTOR SURVEY

3.1.0 OBJECTIVES

The questionnaire (Appendix 2) was designed to elicit information from the service contractors as to their capabilities and their business environment. Specifically the areas covered were:

1. The services provided, which includes the type of work performed, the skills of the employees, the geographic area serviced, and response time.

2. Business conditions, which covers the type of project and contracts and various factors that affect the operation of their business.

3. Energy conservation as a factor in their operations.

4. The qualifications of employees and training available.

In addition to the compilation of all original variables, some of the data was also cross tabulated to determine the variations across the service sector.

3.2.0 METHODOLOGY

A seven page questionnaire (Appendix 2) was developed and pretested on seven service contractors in the Toronto area prior to being mailed to 786 contractors across the Province.

Using a randomized circular systematic sampling procedure, service contractor name and addresses were drawn from "Yellow Page" computer printouts. The lists were of all the advertisers in all the Yellow Pages across Ontario. The following categories were chosen as applicable to the servicing of and energy conservation in multi-unit residential buildings:

Mechanical contractors
Air conditioning contractors
Heating contractors
Ventilating contractors
Caulking contractors
Water treatment service
Air balancing
Insulation contractors
Energy Conservation consultants
Plumbing contractors
Windows metal
Electrical contractors

The lists were reviewed; duplications and those obviously ineligible were removed. A "major company" category was created for the companies that had several branch offices.

Once the master list was prepared, a systematic sample was drawn for mail out purposes. The sample for each contractor type was determined, based on the relative size of the universe and the likelihood of that category performing the work under study. Three sets of labels were prepared - the first for a master file, the second for the initial mailout and the third for the second mailout or postcard reminder.

Surveys were mailed from July 13-15, with postcard reminders going out on July 27 to those who had not yet returned their questionnaire. As responses were received, they were "checked-off" against the master list as completed, refused, not applicable, etc. August 19, 1983 was deemed to be the cutoff date for returns for computer analysis purposes. As of that date, a total of 221 completed questionnaires had been received, coded and processed, representing a completion rate of approximately 30%. By the 26th of August, a total of 282 returns had been received for an overall response rate of 35.9% (See Table 3.1).

TABLE 3.1

QUESTIONNAIRE RETURNS
SERVICE SECTOR SURVEY

NON-USEABLE	RETURNED AFTER DEADLINE	PROCESSED QUESTIONNAIRES	COMPLETED QUESTIONNAIRES
19	21	221	242

MAILED OUT: 786
RESPONSE RATE: 282 or 35.9%
COMPLETION RATE: (786-19) 767 universe
242 of 767 or 31.6%

NOTE: Due to the original cut-off date of August 19, 1983, a total of 221 returned questionnaires were processed. Returns after this date were not included in the computer analysis due to the constraints.

3.3.0 RESULTS

The 221 completed questionnaires received before the cut-off date were processed. These responses came from the following mailing list categories:

TABLE 3.2 Distribution of Respondents by Category

Major company	6
Mechanical	35
Air conditioning	25
Heating	43
Ventilating	4
Caulking	7
Water treatment	1
Air balancing	5
Insulation	11
Energy conservation	10
Plumbing	29
Windows	3
Electrical	42
TOTAL	221

Where a company was listed in the yellow page mailing lists under more than one category, it was included in the category highest on the list above. See section 3.3.5 for the actual services provided.

It was not possible to analyse the results with respect to contractor type as there are too few cases to be valid.

For reasons of brevity and readability, some of the percentages and frequencies given in the text of this section are derived from tables and cross-tabulations not presented in the report but available on the Ministry pintout. The specific occurrences have been marked.

3.3.1 Position of the Respondents

Nearly three quarters of the respondents gave their title as Owner, President, or Vice President.

TABLE 3.3 Title of Respondents (Question A1)

President/Vice President	103
Owner	46
Manager	35
Secretary treasurer	11
Secretary	7
Supervisor	2
Salesman	1
Accountant	1
Sample Size	206

89% of respondents were interested in receiving a copy of the results of this study.

3.3.2 Employees

Over half the respondents reported having 5 or fewer full-time employees. 70% of the respondents who reported having part-time employees employ two or less.

TABLE 3.4 'How many employees do you generally employ?' (Question A3)

Full-time

Number of employees	Count of responses
1-5	114
6-10	49
11-50	43
51-100	5
600	1
Sample size	212

Part-time

Number of employees	Count of responses
None	9
1	31
2	39
3	13
4-10	13
Over 10	3
Sample Size	108

It appears that a high proportion of the employees are certified tradepeople. 86% of the returned questionnaires reported employing one or more certified tradesperson. Half reported employing 3 or fewer.

TABLE 3.5 'How many of your workers are certified tradespeople?' (Question A4)

	Count
None	15
1	26
2	37
3-5	59
6-10	37
11-20	18
21-30	8
31-40	2
Over 40	4
Sample Size	206

3.3.2 Employees (cont'd)

The list of the trades in which the workers were certified includes some that are not traditionally thought of as "Certified Trades", for example "Special Technician" which included air balancing, computer technician, and technical graduates. Plumber, then electrician, were the trades that were most frequently mentioned first.

TABLE 3.6 'Please list trades your workers are certified in:' (Question A4)

Steam/Hot water heating	93
Forced warm air/ventilation	90
Plumber	72
Electrician	62
Refrigeration	41
Building Envelope**	25
Maintenance	8
Special technician	8
Water treatment	3
Other	15
Sample Size	417

43% listed only one trade and another 22% listed two trades, leading one to suppose that the majority of companies would service one or two building systems. In fact, this was not the case. The majority, 61%, serviced more than two building systems. See section 3.3.5.

TABLE 3.7 Number of Certified Trades Listed

Number of Trades Listed	Count of Responses
1	84
2	42
3	35
4	21
5	12
Sample Size	194

**"Building Envelope" includes air sealing, painters, glaziers, construction, etc.

3.3.3 Geographic Area

The questionnaire asked for which geographic areas the companies service. As expected, there was a wide variety of responses, ranging from one town to "Canada". 68% gave only one centre. 8% service all of Ontario, including the 3% who responded with "Canada".

As the sampling was not done by geographic area, the responses are not a reliable measure of the number of contractors in each area.

The responses have been arranged into the areas used for the residential survey. The table below gives the count of responses for each area. When a contractor specified more than one area, he was included in each.

TABLE 3.8 Responses by Geographic Area

Toronto Area	93
Southwestern Ontario	80
Northern Ontario	40
Eastern Ontario	33
Ontario	14
Canada	5
Sample Size	186

3.3.4 Types of Buildings Serviced

Most respondents did not specialize by building type. Industrial and commercial/office drew the most responses. Multi-unit residential buildings, with 20 units or more, drew the fewest, only 54% of the returned questionnaires. More people specialized in industrial and residential under 20 units than in the other types.

TABLE 3.9 'Of your TOTAL work, what percentage would be involved in the following types of buildings?' (Question A6)

	Mean	0-10%	11-30%	31-70%	71-100%	Sample
Industrial	33%	58	58	43	24	183
Institutional	16%	83	37	10	4	134
Commercial/Office	19%	90	69	19	3	181
Retail stores/ Shopping Malls	12%	97	40	5	0	142
Residential less than 20 units	37%	48	38	40	29	155
Residential more than 20 units	21%	63	35	17	4	119

3.3.4 Types of Buildings Serviced (cont'd)

29% of the respondents reported they were not interested in servicing multi-unit buildings, including 10 who reported that these buildings were a percentage of their work.

TABLE 3.10 'Do you provide, or would like to provide, services to residential buildings of 20 units or more?' (Question A7)

Yes, presently provide service	106
Yes, interested in providing service	51
No, not interested in providing service	63
Sample size	220

Those who answered "NO" were instructed to not answer the remaining questions. All the remaining questions dealt with residential structures of 20 units or more. The maximum sample size was now reduced to 157.

3.3.5 Building Systems Serviced

The respondents were asked to indicate which building systems they serviced, choosing from the same list of systems used for the Residential Apartment Questionnaire.

TABLE 3.11 'Which of the following building systems do you service in residential buildings of 20 or more units?' (Question A8)

	Total Responses
Space heating	82
Domestic hot water	75
Ventilation	60
Plumbing	58
Space cooling	56
Automatic controls	53
Electrical	43
Pipe and duct insulation	36
Water treatment	29
Building shell/envelope	26
Laundry room services	25
Other:	
Fire/sprinkler	13
Security/emergency lighting	5
Household appliances	3
Sample Size	149

3.3.5 Building Systems Serviced (cont'd)

Although there was no direct correspondence between the building systems and the mailing list categories, it was interesting that there were 29 respondents who provided water treatment while there was only 1 returned questionnaire from this category. This also happened with ventilation, 60 provided service although there were only 4 returned questionnaires from this category in the yellow page listings.

There appeared to be a fair amount of diversification. 61% of the respondents reported servicing 3 or more building systems. Only 1 respondent checked every box.

TABLE 3.12 Extent of Diversification

Number of Systems Serviced	Count of Respondents
1	37
2	22
3	19
4	21
5	16
6	9
7	10
8	7
9	5
10	3
11	1
Sample Size	149

The 36 companies who serviced only one system, most frequently specialized in either the Building shell/envelope or Electrical systems: 13 of 26 total who serviced building shell and 8 of 43 total who serviced electrical. These systems were also the most frequently omitted when nearly all systems are serviced. Of the 25 respondents who service 7 through 10 systems, only 5 service the building shell and 8 service the electrical system.*

No respondents reported servicing only the space heating or the domestic hot water systems. Both automatic controls and water treatment were combined with at least 2 other systems.*

The grouping of systems serviced appeared to centre around plumbing, heating and electrical. 81% of the respondents were involved in one or more of the three. Of the 28 who were not, 17 serviced the building shell.*

*Data from printout not shown.

3.3.5 Building Systems Serviced (cont'd)

TABLE 3.13 Combinations of Systems Serviced

Plumbing and:	
Domestic hot water	49 of 75 (65%)
Water treatment	22 of 29 (76%)
Laundry room services	20 of 25 (80%)
Fire/sprinkler	5 of 13 (38%)
Plumbing only	6 of 58 (13%)
Heating and:	
Cooling	51 of 56 (91%)
Ventilation	52 of 60 (87%)**
Domestic hot water	55 of 75 (73%)
Automatic controls	47 of 53 (89%)
Fire/sprinkler	11 of 13 (85%)
Heating only	0 of 82 (0%)
Electrical and:	
Automatic controls	22 of 53 (42%) (51% of electrical)
Heating	29 of 82 (35%) (67% of electrical)
Fire/sprinkler	9 of 13 (69%)
Security/ Emergency Lighting	5 of 5 (100%)***
Electrical only	8 of 43 (19%)

The majority, 64%, of respondents did not subcontract any portion of their work. Of those who did, electrical and building shell were the most frequently listed systems on which work was subcontracted out.

TABLE 3.14 'Do you subcontract out any portion of your service work? If yes, please specify.'(Question A9)

Yes	54
No	94
Sample Size	148

Electrical	16
Building shell	12
Automatic controls	8
Plumbing	7
Metal work	6
Other	20

**43 companies provided service to heating, cooling and ventilation systems

***The 5 who serviced security/emergency lighting also serviced fire/sprinkler systems.

3.3.6 Type of Work and Business Conditions

Service appears to be the largest type of work. It formed a higher percentage of the business with half the respondents reporting it was 40% or more. It also drew the most responses, followed by upgrade.

TABLE 3.15 'What percentage of your business is:' (Question A10)

	Mean	0-10%	11-30%	31-70%	71-100%	Sample	Median
Service work	47%	21	40	43	38	142	40%
New construction	38%	31	25	38	15	109	30%
Upgrade or retrofit	33%	25	52	39	8	124	25%
Other	--	2	3	0	2	7	--

The "other" included 4 of energy management/consulting and one each of water treatment, retail supply store and research.

The contractors with a higher percentage of service work were more likely to be involved with upgrades than new construction. Conversely, those with a lower percentage of service work were more involved with new construction.

TABLE 3.16 Proportion of Work in New Construction and Upgrade by % Service Work

	0-10%	11-30%	31-70%	71-100%
New Construction				
0-10%	1	1	12	16
11-30%	1	6	13	3
31-70%	4	25	5	0
71-100%	10	4	0	0
Upgrade or Retrofit				
0-10%	6	1	4	16
11-30%	4	18	19	11
31-70%	3	15	14	0
71-100%	5	0	0	0

Very little service work appears to be done under an on-going contract. Maintenance contracts drew only half the respondents that time and material did, and of those, 47% said it was 10% or less of their service work.

3.3.6 Type of Work and Business Conditions (cont'd)

TABLE 3.17 Contract Type by Percentage of Total Service Work

	0-10%	11-30%	31-70%	71-100%	Sample Size
Maintenance Contract Parts Extra	32	20	13	3	68
Time and Material	7	26	49	52	134
One time job or quotation	32	37	36	22	127
Other: comprehensive contract - parts included	0	1	1	1	3

Repeat business was by far the largest source of business. 63% reported it was the source of over 50% of their business. Direct sales and advertising generated very little business, 77% and 85% respectively reported them as the source of 20% or less of their business.*

TABLE 3.18 Source of Work by Percentage of Total Service Work

	0-10%	11-30%	31-70%	71-100%	Sample Size
Repeat business	2	11	78	51	142
Referrals	46	65	23	1	135
Direct sales	34	33	6	2	75
Advertising	52	22	4	0	79
Other: Tendering	1	2	2	0	5

When asked what factors were important in the operation of their business as expected, reputation was considered very important by nearly all the respondents. None considered it of minor or no importance.

TABLE 3.19 'How important are the following factors in the operation your business?' (Question B1)

	Very Important	Important	Minor Importance	No Importance	Sample Size
Reputation	143	10	0	0	153
Price	48	90	13	0	151
Special Services	62	61	19	1	143
Fast Response	89	52	7	0	148

Fast response was rated as very important by 89 respondents and important by another 52. This was confirmed by another question which asked how fast the average response was. 78% reported responding in 4 hours or less. The two longest times given were 25 and 48 hours.

*Data from printout not shown.

3.3.6 Type of Work and Business Conditions (cont'd)

TABLE 3.20 'What is your average response time on breakdown calls?' (Question A13)

Immediate	3
1 hour	45
2 hours	37
3-4 hours	17
5-8 hours	10
9-24 hours	17
25-48 hours	2
Sample Size	131

24 hour service was also considered important with 76% of the respondents reporting they provide it.

TABLE 3.21 'Do you offer 24 hour service to your customers?' (Question A14)

Yes	108
No	34
Sample Size	142

Problems

A number of problems were outlined in the questionnaire to solicit responses as to their seriousness. Price cutting, by far, was the major issue. Uneven work load and hiring good staff were the areas also reported as serious problems. Problem clients and unreasonable expectations by clients were occasional problems for the majority of respondents.

TABLE 3.22 'How would you rank the following problems in your service business:' (Question B3)

	Serious Problem	A Problem	Occasional Problem	Not A Problem	Not Applicable	Sample Size
Price Cutting	53	35	37	14	2	141
Call Backs	6	5	54	72	4	141
Hiring Good Staff	22	30	41	42	7	142
Training Staff	9	16	30	70	9	134
Uneven Workload	22	31	54	22	8	137
Problem Clients	4	6	72	42	6	130
Unreasonable Expectations by Clients	3	13	75	39	6	136

Hiring good staff and training staff are discussed further in section 3.3.8.

3.3.6 Type of Work and Business Conditions (cont'd)

Most respondents considered each of the factors given in the questionnaire as important in the breakdown of equipment. 56% considered improper maintenance by inhouse staff to be a very important factor. Improper installation, poor design and/or mis-application and poor quality equipment were also considered very important by 40% to 50% of the respondents. Improper maintenance by other service companies was considered the least important. It drew roughly half the responses of the other items and had a much lower proportion of very important responses.

TABLE 3.23 'How important are the following factors in residential equipment breakdown?' (Question A12)

	Very Important	Important	Minor Importance	No Importance	Sample Size
Poor Quality Equipment	53	48	24	3	128
Poor Design and/or mis-application	57	46	21	2	126
Improper Installation	64	43	19	1	127
Improper Maintenance - Inhouse staff	74	39	16	2	131
- Other service company	18	30	22	3	73

Of the list of potential co-ordination problems in the questionnaire, most respondents viewed them as not a problem or an occasional problem. The most common problem was with time scheduling with 59% considering it a common or occasional problem. The others were fairly close ranging from 44% for communications with client to 39% for gap in service.

TABLE 3.24 'Which of the following co-ordination problems are common in your experience?' (Question B2)

	Common Problem	Occasional Problem	Not A Problem	Not Applicable	Sample Size
Building vs. Contract Staff	11	44	55	23	128
Overlap of trades in service work e.g. mechanical vs. electrical	10	45	65.	15	135
Gap in service - nobody to cover a specific area	15	37	67	16	135
Communication with client	14	48	71	8	141
Communication with other trades	12	46	68	14	140
Problems in time scheduling	18	66	50	8	142

3.3.6 Type of Work and Business Conditions (cont'd)

The results from improper maintenance by inhouse staff were cross-tabulated with the results from co-ordination problems involving the building staff. Nearly all who responded that an item was a common co-ordinating problem also considered improper maintenance by inhouse staff to be a very important factor in residential equipment breakdown.

Of those who responded improper maintenance by inhouse staff was a very important factor, 54% considered co-ordination between building and contract staff to be a common or occasional problem. This drops to 46% for communication with the clients and 43% for gap in service. These are all higher than the overall numbers for co-ordination problems, 43%, 39% and 44% respectively.

TABLE 3.25 Co-ordination Problems vs. Importance of Improper Maintenance by Inhouse Staff

	Improper Maintenance by Inhouse Staff			
	Very Important	Important	Minor Importance	No Importance
Common Problem				
Building vs. Contract Staff	8	1	0	0
Gap in Service	9	4	0	0
Communication with Client	11	2	1	0
Occasional Problem				
Building vs. Contract Staff	26	13	2	0
Gap in Service	20	9	5	0
Communication with Client	21	20	3	0
Not a Problem				
Building vs. Contract Staff	17	17	11	0
Gap in Service	30	22	9	0
Communication with Client	33	14	12	0
Not Applicable				
Building vs. Contract Staff	12	5	1	1
Gap in Service	9	2	1	1
Communication with Client	4	1	0	1

3.3.7 Energy Related Service

There appears to be a large potential for cost-effective energy savings. Half the respondents reported that 75% or more of the buildings they service have this potential.

TABLE 3.26 'What percentage of the buildings you service have potential for cost-effective energy savings?' (Question C1)

% of buildings	Count of responses
0-10%	7
11-30%	21
31-70%	34
71-90%	31
Over 90%	35
Sample Size	128

This was confirmed in another question, C4, where two thirds of the respondents did not feel the owners have taken all necessary action. However, little of the work performed is related to energy conservation. Half reported it was 25% or less. The most frequent response was 10%.*

TABLE 3.27 'What percentage of your work is directly related to energy conservation?' (Question C2)

% of work	Count of responses
0-10%	44
11-30%	38
31-70%	24
71-90%	8
Over 90%	17
Sample Size	131

Energy conservation did not rate as an important issue when selling their services. Less than half the respondents actively propose energy conservation measures, and of those, less than 60% always provide the estimated energy savings. Other financial information was even less frequently provided.

*Data from printout not shown.

3.3.7 Energy Related Service (cont'd)

TABLE 3.28 'Do you actively propose or sell energy conservation measures to apartment buildings owners?' (Question C3)

No	72
Yes	68
Sample Size	140)

'If yes, do you provide any of the following information?' (Question C3)

	Not Applicable	Never	Sometimes	Always	Sample Size
Capital cost of measure	8	1	25	36	70
Estimated energy savings	2	1	29	43	75
Simple payback of measure	3	3	27	37	70
Life cycle cost	5	9	31	18	63
Recommend other specialty firm	5	8	44	7	64

The Contractors perception of the buildings owners' attitude to energy conservation was of interest. The "typical" owner was concerned but had not taken all necessary action and definitely did not want to spend money on conservation measures. The respondents were evenly divided on the issues of whether the owners were upgrading their buildings and whether they were making poor decisions.

TABLE 3.29 'In general, how would you describe the building owner's owner's attitude to energy conservation?' (Question C4)

	True	Usually True	Usually Not True	Not True	Don't Know	Sample Size
Owner doesn't care	9	25	60	32	7	133
Owner concerned:						
- has taken all necessary action	5	21	52	26	15	119
- is upgrading building	10	42	45	10	16	123
- makes poor decisions	13	34	37	12	23	119
- does not want to spend money	46	67	7	3	9	132

3.3.7 Energy Related Service (cont'd)

When asked to list the most frequent energy related upgrades made, the most frequent responses were with automatic controls, followed by upgrades to the heating system equipment.

A maximum of 4 upgrades were listed on some questionnaires. 75% of the 117 respondents listed one or two.*

TABLE 3.30 'Please list the most frequent energy-related upgrade measures you make in the course of your work.'(Question C5)

Automatic Controls		75 total
Thermostats/Heating Controls	42	
Energy Conservation Controls	10	
General Automatic Controls	23	
System Equipment		68 total
Conversions (oil to gas/electricity)	26	
High efficiency boilers	10	
Heat Exchangers	7	
Heat Pumps	8	
Lighting	17	
System Operation		42 total
Returning system operation to original intended design	9	
Improve equipment	17	
Improve air handling efficiency	12	
Zoning	4	
Other Energy Measures		40 total
Air sealing/caulking/weatherstripping	13	
Insulation (building and equipment)	12	
Water saving products	11	
Windows/solar	4	
Other		30 total
Advice	10	
Boiler cleaning/de-scaling	9	
Other maintenance	7	
Miscellaneous	4	
Sample Size	256	

*Data from printout not shown.

3.3.8 Job Training and Qualification

The vast majority of respondents reported employing certified tradespeople, but few respondents reported employing engineers or technologists. Nearly twice as many reported employing technicians, but this was still far short of the proportion reporting employing certified trades.

TABLE 3.31 Employee Qualifications

Employing:	Count	Sample Size	% of Sample Size	% of max. Sample Size
Engineers	39	103	38%	25%
Technologists	37	102	36%	24%
Technicians	73	111	66%	46%
Certified Trades	191	206	93%	86%

62% are not employing engineers. Of those who do, 64% only employ one.

TABLE 3.32 'How many of your workers have qualification equivalent to:' (Question D2)

	Engineer	Technologist	Technician
None	64	65	38
1	25	15	20
2	6	11	19
3	4	2	8
4	1	4	8
5	0	1	5
6	1	2	2
Over 6	2	2	11
Sample Size	103	102	111
Highest Number	10	12	33

Although the majority, 68%, of companies reported no problems in finding trained personnel, almost a third of the respondents reported that there were trades in which they were having difficulties in finding fully trained tradesmen. The most frequently cited field was refrigeration.

3.3.8 Job Training and Qualification (cont'd)

TABLE 3.33 'Are there any trades for which you have difficulty finding trained service tradesmen? If yes, what are they?' (Question D1)

No	96
Yes	45
Sample Size	141

Refrigeration	14
Heating/furnace testing	6
Gas fitters	5
Air sealing	3
Controls	3
Other	17
Sample Size	48

It is interesting to compare the above results to that of question B3 - hiring good staff. 17 of 21 who rated hiring good staff as a serious problem also have difficulty finding fully trained service tradesmen. However, only a third of each of the "a problem" and "occasional problem" groups had this difficulty. It appears that their problem is not with tradesmen.*

The responses to hiring good staff were also cross-tabulated with the building systems serviced. The variations were slight. 36.6% of all respondents consider hiring good staff a problem or a serious problem. By building system, the lowest were building shell and plumbing at 27%. The highest was space cooling at 44%. This agrees with question D1 where fully trained refrigeration personnel was most frequently cited as difficult to find. However, with space heating, the correlation disappears. Heating, furnace testing and gas fitters combined were cited nearly as frequently as refrigeration personnel, but there was no difference between the views of those servicing space heating and the views of all the respondents (on this topic).*

It is interesting that training staff is not viewed as a problem by the majority of respondents. It appears that solutions to this potential problem have already been developed and implemented.

In general, the respondents were satisfied with the technical education provided by the various types of institution or organizations. Half the respondents reported that universities were not applicable to their field of work. This is reasonable in view of the low number employing engineers.

Trade associations were the highest regarded, with 30% reporting they were very satisfied and only 17% dissatisfied. Community colleges were also highly rated, with 21% very satisfied and 15% dissatisfied.

*Data from printout not shown.

3.3.8 Job Training and Qualification (cont'd)

Unions, however, were rated very poorly, with 45% expressing dissatisfaction. They also drew the lowest proportion of very satisfied responses, 10%.

Technical high schools were also rated poorly, with 30% expressing dissatisfaction.

The above percentages exclude the not applicable and don't know replies.

TABLE 3.34 'Are you satisfied with the technical education provided by provided by the following institutions as related to your company's field of work?' (Question D3)

	Universities	Community Colleges	Technical High Schools	Trade Associations	Manufacturers	Unions
Very Satisfied	6	22	17	31	18	8
Generally Satisfied	25	66	54	55	63	36
Dissatisfied	6	14	25	11	21	25
Very Dissatisfied	1	2	5	7	2	11
Don't Know	25	16	17	13	17	19
Not Applicable	67	13	17	18	13	35
Sample Size	130	133	135	135	134	134

As expected, the respondents who were not having difficulty in finding fully-trained tradesmen were more satisfied with the technical education than those who were having difficulty.*

*Data from printout not shown.

3.3.8 Job Training and Qualification (cont'd)

Respondents were asked about possible areas for improvement in educational programs; upgrading the education or updating courses was most frequently cited, followed closely by increasing hands-on training. Some specific topics mentioned were: blueprint reading and interpretation, electrical controls and diagrams, and training in service of natural gas fired equipment. Dedication to work and job aptitude were also listed. One thought-provoking remark was 'Encourage intelligent high school students as tradespeople instead of just slow learners.'

TABLE 3.35 'Please describe any specific items which you feel need improvement in the area of educational programs.' (Question D4)

Upgrading of education/ updating of courses	24
Increase hands-on training	21
Upgrading of teachers	8
Dedication to work	8
Job aptitude	6
Co-ordination in energy conservation	3
Sample Size	70

Very few respondents listed any program, course seminar or workshop which provided useful training. There were only 17 responses, of which 7 were community colleges and 6 were manufacturers/suppliers.

4.0.0 SITE INSPECTIONS

4.1.0 OBJECTIVES

The purpose of the inspections was to validate and highlight the previous findings. It was not intended to provide exhaustive case studies of individual buildings. The site inspections were intended to be completed in half a day per building and were to yield the following information.

1. Verification of the accuracy of response to the owner's questionnaire.
2. Detailed information from the service contractor regarding the specifics of maintenance and upgrades of the sample building.
3. An assessment of the adequacy of the servicing.

4.2.0 METHODOLOGY

The Toronto area owners' questionnaire returns were reviewed and a sample of buildings exhibiting apparently 'typical' conditions were selected and owners' approval for inspection sought. Ten buildings were selected for site visits based on the following variables:

1. Building Size - number of suites
2. Building Type - rental/co-op/condo
3. Heating Fuel - oil/gas/electric
4. Completeness of the questionnaire returned
5. Building age

Buildings selected represent a mix of sizes, building types, ages and heating fuel. The sample of ten buildings represents a broad cross-section of the building stock.

Site visits were arranged through the contact person listed on the residential apartment survey questionnaire. The contact person interviewed during the site visit was not necessarily the same person who completed the questionnaire. In some cases a property manager completed the questionnaire whereas the building superintendent was interviewed during the site visit. In all cases, the person interviewed was responsible for operating the on site equipment and calling outside service contractors for breakdown repairs.

An independent service contractor was present at all site inspections to:

1. Assist in the equipment inspection
2. Start up boilers as required
3. Assist in a review of service procedures.

4.2.0 METHODOLOGY (cont'd)

Where possible, the main service contractors were contacted but this did not yield useful information. Many buildings did not have a "key" contractor.

4.3.0 RESULTS

Site surveys showed that all buildings exhibited some form of service problem at the time of the site visit. A corridor air supply unit temperature setpoint can be reduced to 50°F to avoid unnecessary heating. This permits better utilization of solar gains. The supplied domestic hot water temperature should never be higher than 140°F. The energy conservation issues identified for each building are summarized below.

TABLE 4.1 Summary of Site Survey Results

Building	Year Built	Units	Type	Energy as % of Operating Costs	Comments
1	1979	254	Condo	45%	Corridor Supply-filters plugged - mix air temp. 65°F Stairwell Fan-dampers for smoke exhaust full open Storage DHW 145°F Incandescent Hall Lights
2	1974	65	Condo	45%	Incandescent Hall Lights Corroded DHW burners DHW Temp. 140°F Corridor Supply-plugged filter-mix air temp. 65°F DHW boilers short cycle due to control problem
3	1956	23	Co-op	45%	Incandescent Hall Lights Exhaust fan 24 hour operation DHW 160°F
4	1965	77	Rental	46%	Corridor Supply 24 hour operation Exhaust 12 hour winter operation

4.3.0 Results (cont'd)

5		60	Rental	-	Natural ducted exhaust Variable ventilation DHW piping system causes short cycling One valve defective Very leaky windows $7000 estimate for fix up ($115/suite) DHW temp. 140°ff
6	1968	231	Rental	-	Incandescent Hall Lights DHW temp. 170°F DHW control problems corroded burners Overheating problem in winter months Corridor supply 24 hours filter plugged Exhaust 24 hours No heating unit on corridor make-up air Suite heaters pick up the slack
7	1960	38	Rental	8%	Boiler firing timing - out due to dirty or defective sensoring device Localised heat problem for suites with garage underneath No exhaust/ventilation fans
8	1977	265	Condo	45%	Sliding glass doors in balcony major leakers Poor filter condition in corridor supply Temp. setting 65°F Indoor/outdoor controller throttling range too low DHW circulation pump failure due to high temperature overload Possible problem with controls Timeclocks and other controls recently added
9	1976	113	Condo	54%	Corridor Supply 24 hour Leakage problem at exit doors/basement doors

4.3.0 Results (cont'd)

10	1953	33	Rental	62%	Central exhaust system of 2 fans, one fan broken but motor still running 10 hour operation of exhaust fan by timeclock Several major retrofit items have reduced large energy consumption of past years.

The checking of questionnaire responses to actual building characteristics revealed very few inconsistencies:

TABLE 4.2 Verification of Questionnaire Responses

Question	Remarks
A5	Year built was checked against drawings and equipment and found to be accurate within one year.
A7	Problem with rear splits for low rise where half of floor level is exposed, otherwise accurate.
C3	The accuracy of this statistic was difficult to validate. In many cases realty taxes were included. Condominium and co-ops generally referred to their operating statement which showed taxes but not financing charges.
D1	Some confusion between CENTRAL versus INDIVIDUAL. For example, a central boiler with a fan coil in the suite may generate two checks. Also an occasional problem with differentiation between the space heating system and the domestic hot water system.
D2	No significant problem.
D3	Ventilation systems were not well understood. Exhaust and supply units were often confused. Function of specific fans were often unknown.
D4	No significant problem with the exception of confusion noted in D1.
D5	Type of construction sometimes miscoded.
D6	Some buildings have mixed lighting which requires multiple choices.
D7	No significant problem.
D8	No significant problem.
D9	No significant problem.
D10	No significant problem.
D11	No significant problem.

4.4.0 OBSERVATIONS

General

1. Continuous operation of corridor supply fans and central exhaust fans.
2. Corridor supply units had plugged filters in most buildings.
3. Corridor supply unit was set to maintain 65^{o}F supply air temperature.
4. Indoor/outdoor controller settings were not well understood by building operation personnel.
5. Domestic hot water control settings often led to short cycling of the boilers.
6. One half of the buildings maintained higher than normal domestic hot water temperature.
7. Sliding glass doors and windows were an infiltration problem in buildings.
8. Building boilers tested very high in combustion efficiency in all buildings.

Condominiums

The condominium buildings were generally larger and newer buildings with better quality HVAC systems. Exhaust fans and corridor supply fans were more common to this type of building. Maintenance and upkeep received a higher priority than in a rental building.

Service maintenance was generally handled by a large well-known service contractor.

The HVAC systems in this building group were generally more complex and provided good potential for energy conservation measures.

Rental Buildings

The rental buildings were generally older building stock than the condominiums. Service contracts were oriented towards a breakdown type of maintenance.

The in-house staff for a rental building cannot easily evaluate the technical ability of a service contractor. Often, the service contractor was appointed by the building owner for a group of buildings.

Older rental buildings were more prone to infiltration problems around window sash and balcony doors. Heating system controls were not designed to deal with localised infiltration problems.

The hot water schedule must be turned up to accommodate the worst suite condition. The result was overheating in some suites; the tenants responded by opening windows. Solutions to this type of problem require a comprehensive systems approach rather than specific building maintenance.

4.4.0 Observations (cont'd)

Co-op Buildings

The co-op buildings were similar in concept to condominium buildings, however, this site survey reviewed only one co-op building. No generalization can be made regarding co-op buildings.

In general, the smaller condominium and co-op building owners had more active participation in the selection and monitoring of building service contractors. Larger buildings hired a property manager to deal with day to day concerns.

5.0.0 SUPPORT SERVICES

5.1.0 OBJECTIVE

The objective was to identify the organizations providing training, education and other forms of support services, and to determine the extent and nature of these services. Where possible, the target groups would be identified and the performance quality investigated.

5.2.0 METHODOLOGY

Trade associations and community colleges were contacted first, as they were known for providing training and education. It was quickly realized that there was an amazing wealth of support services available and it was well beyond the scope of this project to do justice to this topic.

5.3.0 RESULTS

5.3.1 Trade Associations

For many trade associations, the primary function was to be the bargaining agents. Others were formed because their members felt the need for information relating to their industry. They all provided some level of information transfer. The level ranged from periodic meetings through occasional guest speakers, seminars, full courses to active involvement in certification programs. As would be expected, the target group varied with the aims of the association, from only those involved with a specific collective agreement to all those who were in some way involved in the industry.

Canadian Building Magazine, Maclean Hunter publishes "Real Estate Development Annual" which lists industry related associations.

The Corpus Almanac & Canadian Sourcebook, available through Southam Communications Ltd., lists associations across Canada, by subject heading.

5.3.2 Community Colleges

All the colleges contacted gave courses that were relevant to energy conservation in multi-unit residential buildings, from 3 year full-time programs through part-time to continuing education. Some courses were explicitly related, for example, Building Operations Management or Building Environmental Systems. Frequently the course was more general, for example, the Mechanical Engineering Technology programs.

Community colleges are in the business of providing training and education and readily adapt to meet the current needs.

5.3.2 Community Colleges (cont'd)

The Ministry of Colleges and Universities publishes a directory of courses available.

The Metro Toronto Library Board publishes a directory of continuing education courses given by over 70 institutions.

Construction Management Institute publishes "Education for Management in Construction", a directory of 220 courses across Canada that are relevant to construction and property management.

RESIDENTIAL APARTMENT SURVEY

Please answer questions by checking the appropriate boxes or writing your answer next to the question. When you are finished, please return the questionnaire in the POSTAGE PAID envelope before June 17, 1983. All information will be kept strictly confidential.

PART A: GENERAL INFORMATION

A1

Name and Address of Building	Postal Code
Name and Address of Owner (if available)	Postal Code

Person(s) Completing Information Sheet	Position/Title	Telephone (ext.)	Date

A2 Are you interested in receiving a copy of the results from the study?

☐ Yes ☐ No

A3. Which of the following terms best describes the ownership of the building?

☐ private sector, rental ☐ public housing
☐ co-operative ☐ condominium
☐ non-profit

A4. Is the building managed by:

☐ the owner
☐ an outside organization
☐ other (specify) _____

A6 Which year was the building completed (estimate if unknown)? (Year) _____

A5 How many apartment units are there in this building? (Units) _____

A7 How many storeys are above grade (count the ground floor as first storey)? (Storeys) _____

A8 Do you have a set of 'as is' structural, electrical, and mechanical drawings for this building?

☐ Yes, all ☐ Yes, some ☐ No, none

A9 Do you have a set of operating manuals for all the systems in this building?

☐ Yes, all ☐ Yes, some ☐ No, none

PART B: DEFINITIONS

The following provides a series of definitions of the terms which will be used throughout this questionnaire. Please read the definitions prior to completing the remaining questions.

B1. SCHEDULED MAINTENANCE - regularly scheduled service including lubrication, routine maintenance and minor repairs, e.g., cleaning filters, replacing washers.

B2 BREAKDOWN REPAIRS - non-scheduled service such as repairing or replacing an item after a failure, e.g., a pump. A new boiler would be considered an upgrade.

B3. UPGRADE - this is a one time or an occasional action, e.g., replacing the boiler, adding storm windows, non-scheduled 'tune-ups'.

B4. (IN)HOUSE SPECIALISTS - applies to larger organizations where there is a group of people who supply specialized skills to many buildings, but are directly employed by the building owner/manager (e.g., electrician, or plumber).

B5. BUILDING SUPERINTENDENT/STAFF - people who are more or less responsible for this building, or cluster of buildings for routine maintenance.

PART C: GENERAL APPROACH TO ENERGY

C1. How are energy consumption trends monitored in this building?

☐ Periodic financial assessments ☐ Outside energy management service
☐ Utility records ☐ Not formally monitored
☐ In-house meter reading ☐ Other (specify) _____
☐ Automatic data acquisition system : _____

C2. How major a factor is energy consumption in the profitable operation of this building?

☐ Very important ☐ Important ☐ Minor importance ☐ No importance

C3. Energy forms approximately what percentage of total operating costs (excluding realty taxes and financing). Estimate or give a range of answers.

_____ %

3

C7. In your opinion, how serious are the following as barriers which prevent you from improving the energy performance of this building?

	Very Serious	Serious	Minor Effect	No Effect	Advantage	
Base Review						26
Lack of Capital Funds						27
Lack of Operating Cash						28
Lack of Information						29
Conflicting Information						30
Conservation Not Proven Cost Effective						31
Building Already At Optimum Performance Level						32
Lack of Trained Staff, ie. Training Required						33
Difficulties in Accessing Priorities						34
Service Organizations Inadequate						35
Service Organizations Unavailable						36
Resident Problems						37
Energy Bills Paid By Residents						38
Other (Specify)						39

C8. In general, how is energy-related maintenance handled? 40

- ☐ Mostly by onsite superintendent/staff
- ☐ Mostly by in-house specialists, with outside specialists as required
- ☐ Mostly by outside service organizations
- ☐ Other (specify): _____

C9. Are you generally satisfied with the service provided by in-house staff? 41

- ☐ Very Satisfied
- ☐ Satisfied
- ☐ Adequate
- ☐ Dissatisfied
- ☐ Very Dissatisfied

4

C10. Which types of contract do you have for outside contractors? 42 43

- ☐ By upgrade project or one time job
- ☐ Full maintenance package
- ☐ Preventive maintenance package
- ☐ Time and Material
- ☐ Other (specify) _____

C11. Should you be interested in a total service contract, i.e., one organization to look after all service work? 44

☐ No ☐ Yes

If No, please explain _____

C12. Do you have problems with service people not understanding how building systems must work together? 45

☐ Yes ☐ No ☐ Don't know

C13. Have any energy studies or audits been performed on this building? 46

☐ Yes ☐ No

a) If yes, by: 47 48

- ☐ In-house staff
- ☐ Consultants
- ☐ Contractors or Suppliers
- ☐ Government Agencies
- ☐ Utility Company
- ☐ Other (Specify)

b) Were you satisfied with the level and accuracy of the information provided? 49

- ☐ Very Satisfied
- ☐ Satisfied
- ☐ Adequate
- ☐ Dissatisfied
- ☐ Very Dissatisfied

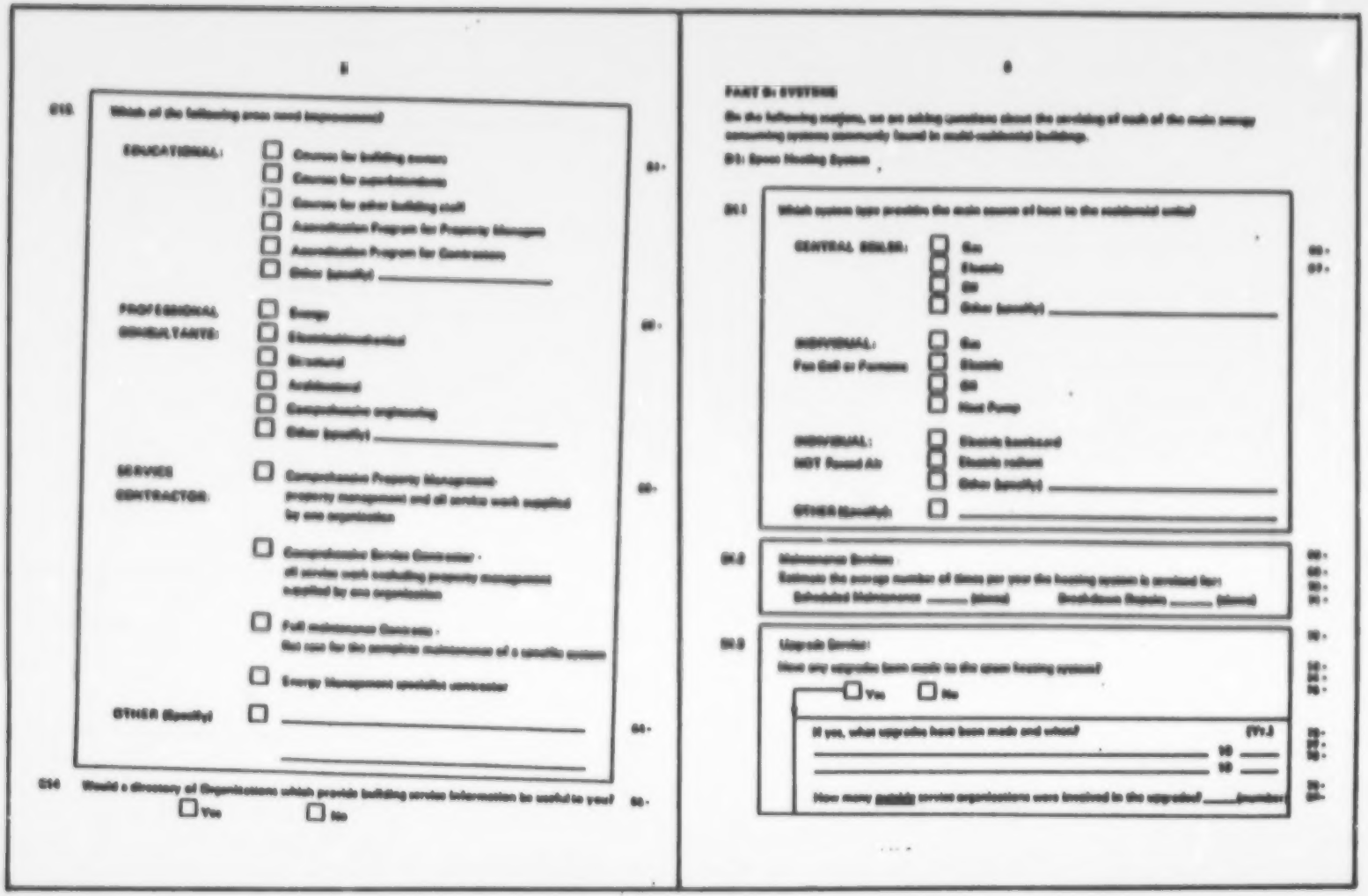
C14. Has this building taken advantage of any Government Programs whether energy-related or not? 50

☐ Yes ☐ No

If yes, which programs and when? (Yr.) 51 52 53 54 55 56 57 58

_____ 19 ____

_____ 19 ____



Q15 Which of the following areas need improvement?

EDUCATIONAL:
- ☐ Courses for building owners
- ☐ Courses for superintendents
- ☐ Courses for other building staff
- ☐ Accreditation Program for Property Managers
- ☐ Accreditation Program for Contractors
- ☐ Other (specify) _____

PROFESSIONAL CONSULTANTS:
- ☐ Energy
- ☐ Electrical/mechanical
- ☐ Structural
- ☐ Architectural
- ☐ Comprehensive engineering
- ☐ Other (specify) _____

SERVICES CONTRACTOR:
- ☐ Comprehensive Property Management - property management and all service work supplied by one organization
- ☐ Comprehensive Service Contractor - all service work excluding property management supplied by one organization
- ☐ Full maintenance Contractor - Not now for the complete maintenance of a specific system
- ☐ Energy Management specialist contractor

OTHER (Specify)
- ☐ _____
- _____

Q16 Would a directory of Organizations which provide building service information be useful to you?
☐ Yes ☐ No

PART D: SYSTEMS

On the following pages, we are asking questions about the servicing of each of the main energy consuming systems commonly found in multi-residential buildings.

D1: Space Heating System

D1.1 Which system type provides the main source of heat to the residential units?

CENTRAL BOILER:
- ☐ Gas
- ☐ Electric
- ☐ Oil
- ☐ Other (specify) _____

INDIVIDUAL: Fan Coil or Furnace
- ☐ Gas
- ☐ Electric
- ☐ Oil
- ☐ Heat Pump

INDIVIDUAL: HOT Forced Air
- ☐ Electric baseboard
- ☐ Electric radiant
- ☐ Other (specify) _____

OTHER (Specify)
- ☐ _____

D1.2 Maintenance Services

Estimate the average number of times per year the heating system is serviced for:

Scheduled Maintenance _____ (times) Breakdown Repairs _____ (times)

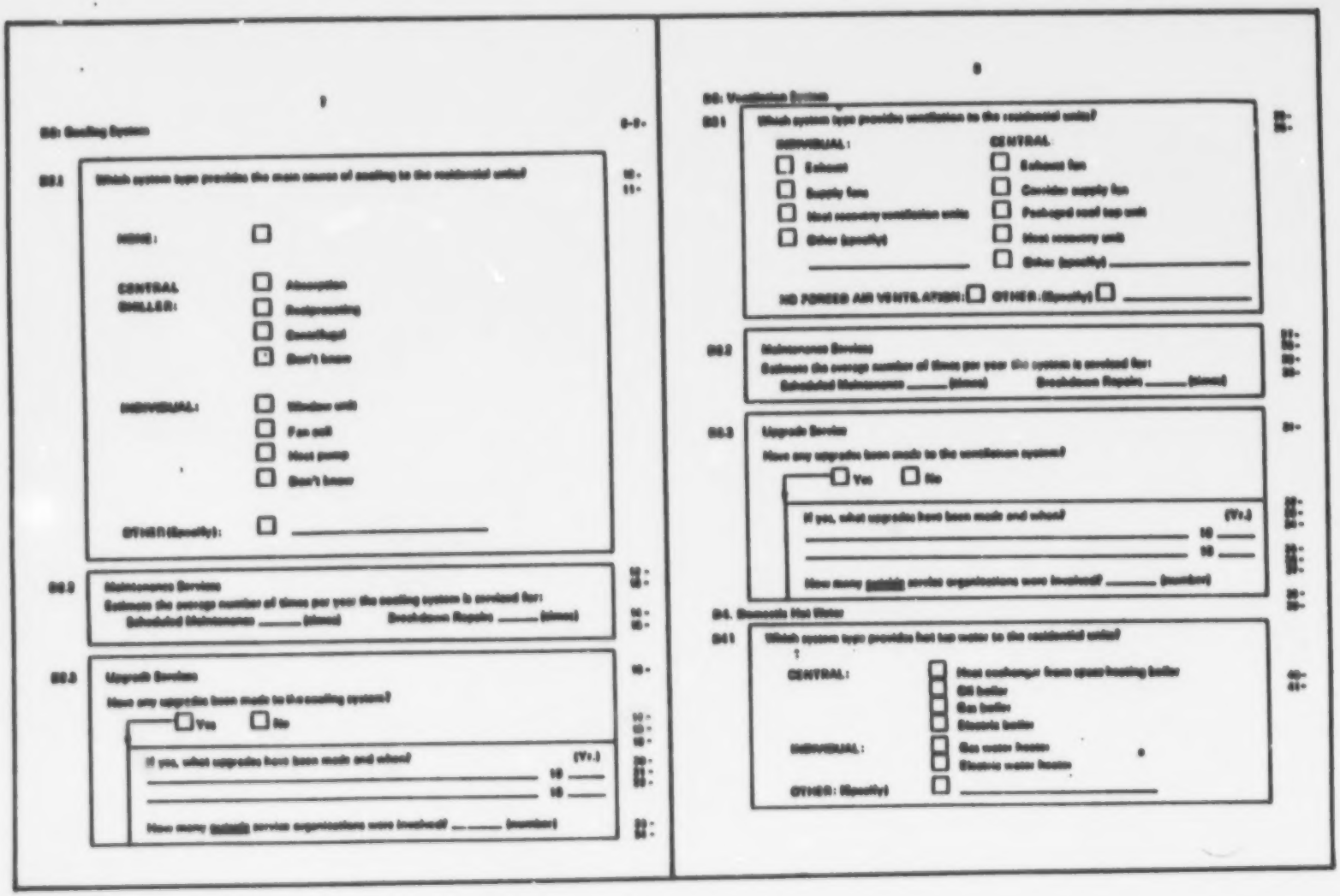
D1.3 Upgrade Service:

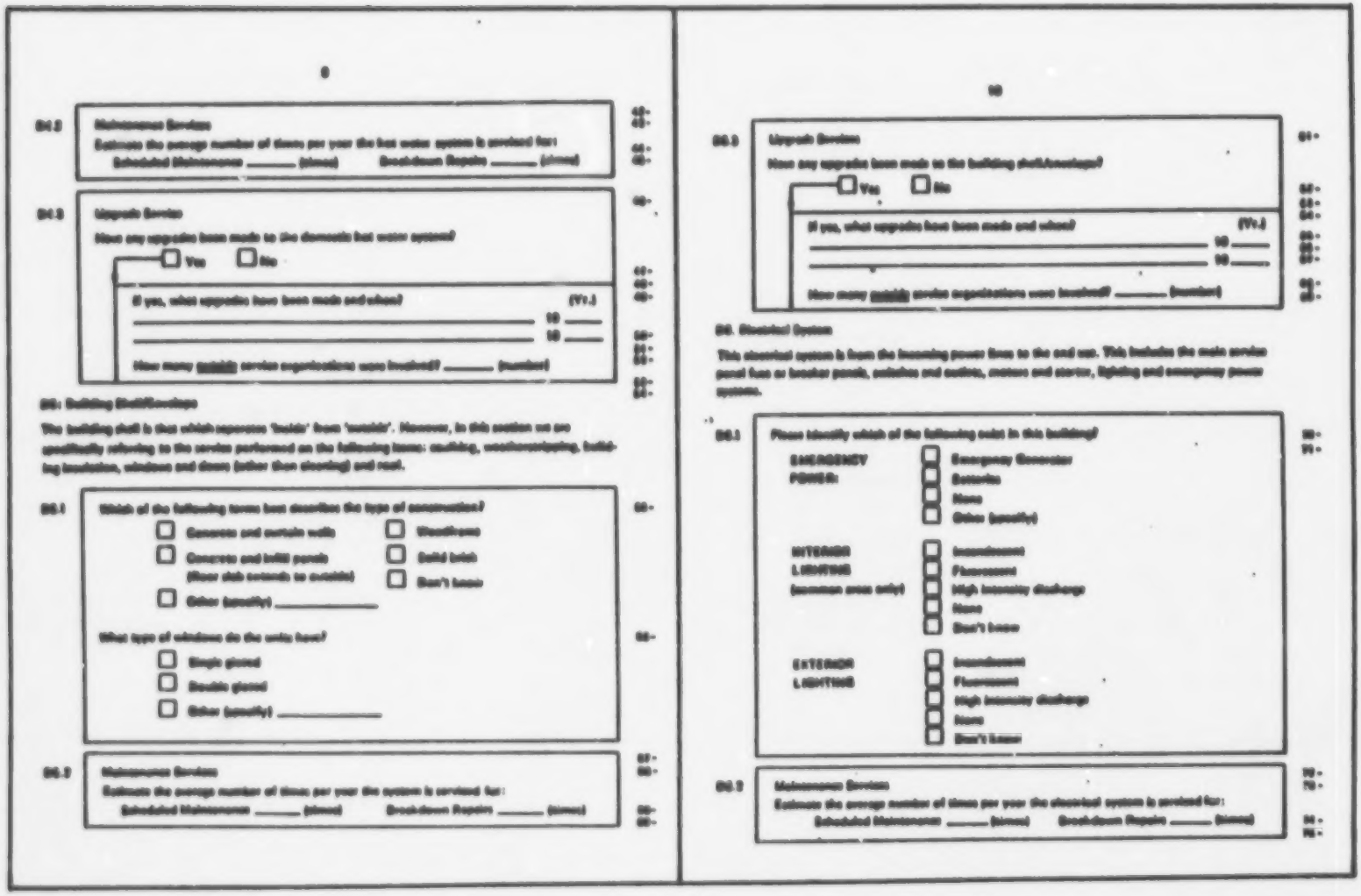
Have any upgrades been made to the space heating system?

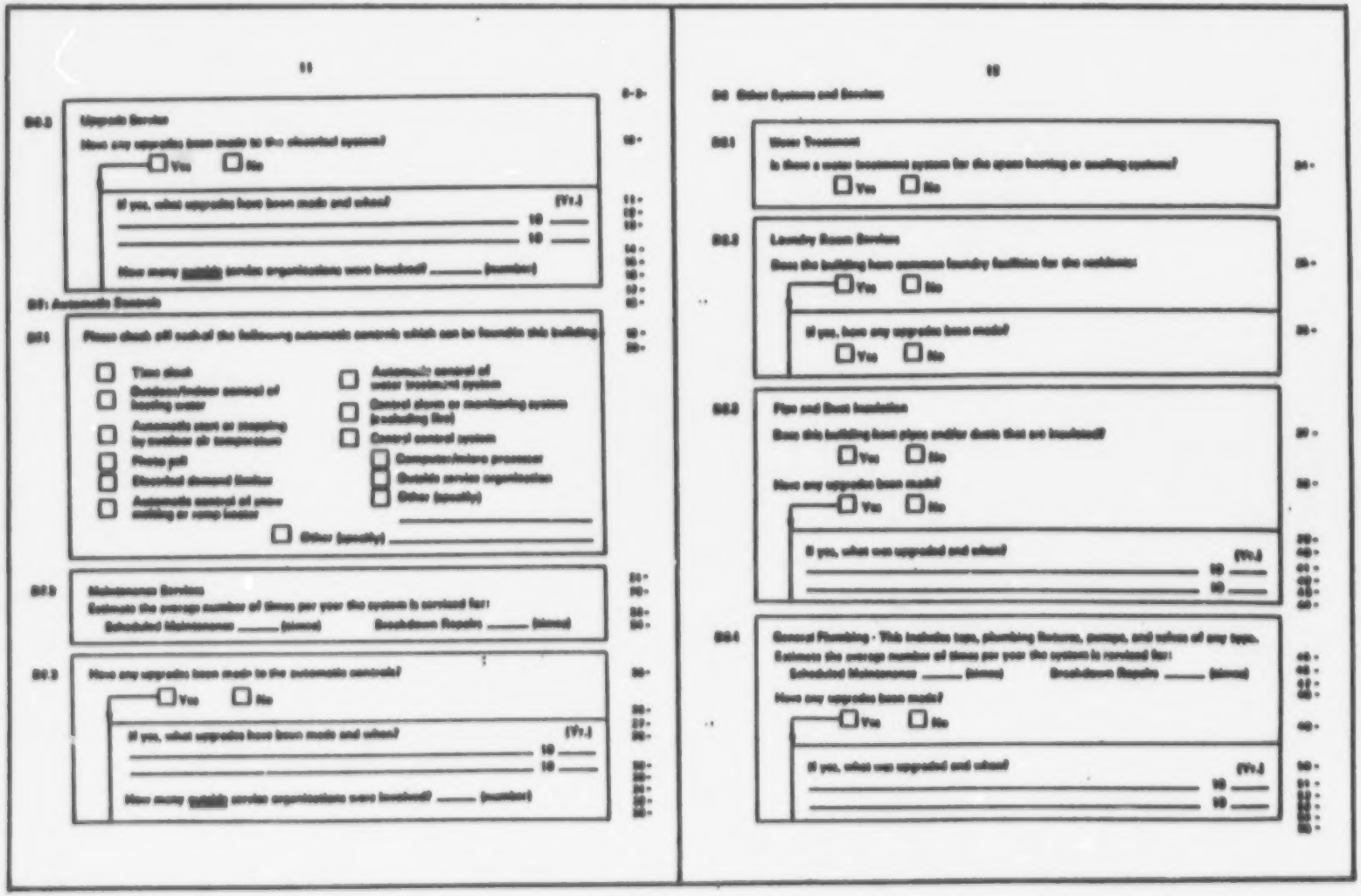
☐ Yes ☐ No

If yes, what upgrades have been made and when? (Yr.)
- _____ Yr. ____
- _____ Yr. ____

How many outside service organizations were involved in the upgrades? _____ (number)







13

D5.5 Air and Water Balancing

How often is balancing done on ventilation, central heating or cooling systems?

- ☐ Never
- ☐ Regularly every _____ years (specify time frame)
- ☐ Once, _____ years ago (estimate time)
- ☐ Don't know

Who provides the balancing service?

- ☐ Outside service organization
- ☐ Building superintendent/staff
- ☐ In-house specialist
- ☐ Other (specify) _____

D5.6 Garage

Do you have a heated garage and/or ramp heater?

- ☐ Both
- ☐ Heated Garage
- ☐ Ramp Heater
- ☐ Neither

Have any upgrades been made to the garage?

- ☐ Yes
- ☐ No

If yes, what was upgraded and when?

	(Yr.)
_____	19 ____
_____	19 ____

D5.7 Other Energy Consuming Systems

Are there any other energy consuming systems in this building?

- ☐ Yes
- ☐ No

If yes, what: _____

Have any upgrades been made to the cooling system?

- ☐ Yes
- ☐ No

If yes, what has been upgraded and when?

	(Yr.)
_____	19 ____
_____	19 ____

14

D6. Who provides ongoing service for the following systems? Fill in all appropriate categories. Give number for outside service organizations used under each category.

		Your Employees	Outside Service Organizations	Owner/Tenant	Building Staff/ Superintendent	Your Contract Engineers	Other (Specify)
SPACE HEATING SYSTEM	Maintenance Services						
	Breakdown Repairs						
COOLING SYSTEM	Maintenance Services						
	Breakdown Repairs						
VENTILATION SYSTEM	Maintenance Services						
	Breakdown Repairs						
DOMESTIC HOT WATER	Maintenance Services						
	Breakdown Repairs						
ELECTRICAL SYSTEM	Maintenance Services						
	Breakdown Repairs						
BUILDING/SHELL ENVELOPE	Maintenance Services						
	Breakdown Repairs						
WATER TREATMENT	Maintenance Services						
	Breakdown Repairs						
LAUNDRY ROOM SERVICES	Maintenance Services						
	Breakdown Repairs						
GENERAL PLUMBING	Maintenance Services						
	Breakdown Repairs						
PIPE AND DUCT INSULATION	Maintenance Services						
	Breakdown Repairs						
AIR AND WATER BALANCING	Maintenance Services						
	Breakdown Repairs						
AUTOMATIC CONTROLS	Maintenance Services						
	Breakdown Repairs						
GARAGE	Maintenance Services						
	Breakdown Repairs						
OTHER SYSTEM (D. D.S.?)	Maintenance Services						
	Breakdown Repairs						

D10. How many outside service organizations do you use on a regular basis (exclude non-energy related services such as cleaning and grounds keeping)? _____ (number)

Q31. Are you satisfied with the service provided by OUTSIDE service organizations for the following systems? "Maintenance" includes both scheduled and breakdown.

		Not Applicable	Very Satisfied	Generally Satisfied	Dissatisfied	Very Dissatisfied	
SPACE HEATING SYSTEM	Maintenance						40
	Upgrade						41
COOLING SYSTEM	Maintenance						42
	Upgrade						43
VENTILATION SYSTEM	Maintenance						44
	Upgrade						45
DOMESTIC HOT WATER	Maintenance						46
	Upgrade						47
ELECTRICAL SYSTEM	Maintenance						48
	Upgrade						49
BUILDING SHELL/ENVELOPE	Maintenance						50
	Upgrade						51
WATER TREATMENT	Maintenance						52
	Upgrade						53
LAUNDRY ROOM SERVICES	Maintenance						54
	Upgrade						55
GENERAL PLUMBING	Maintenance						56
	Upgrade						57
PIPE AND DUCT INSULATION	Maintenance						58
	Upgrade						59
AIR AND WATER BALANCING	Maintenance						60
	Upgrade						61
AUTOMATIC CONTROLS	Maintenance						62
	Upgrade						63
GARAGE	Maintenance						64
	Upgrade						65
OTHER SYSTEM (Q. 30.1)	Maintenance						66
	Upgrade						67

PART 5: OTHER

Q1. Are there specific areas which you are dissatisfied with the service provided to the building? ☐Yes ☐No 68 69 70

If yes, could you briefly describe what you are dissatisfied with?

Q2. If possible, please attach a list of names and addresses of the OUTSIDE service organizations referred to in the previous questions. 71 72

Q3. If you have any additional information or suggestions 'on this whole topic area', please feel free to make them below.

Service Contractor Survey

Please answer questions by checking the appropriate boxes or print your answer next to the question. When you are finished, please return thy questionnaire in the POSTAGE PAID envelope before July 22, 1983. All information will be kept strictly confidential.

PART A: General Information

A1.

Company Name	Contact Person	Title
Mailing Address	Postal Code	Telephone Number

A2. Are you interested in receiving a copy of the results from this study?

☐ Yes ☐ No

A3. How many employees do you generally employ?

full-time ____ (number)
part-time ____ (number)

A4. How many of your workers are certified trades people?

____ (number)

Please list trades your workers are certified in:

A5. What geographic area does your company service? Please specify major centres covered.

A6. Of your TOTAL work, what percentage would be involved in the following types of buildings?

– Industrial	___ %
– Institutional	___ %
– Commercial, office	___ %
– Retail Stores/Shopping Malls	___ %
– Residential-less than 20 units per building	___ %
– Multi-Unit Residential (more than 20 units/building)	___ %
TOTAL	100.0%

A7. Do you provide, or would you like to provide, services to residential buildings of 20 or more units?

☐ Yes, presently provide service
☐ Yes, interested in providing service
☐ No, not interested in providing service

IF YOU DO NOT PRESENTLY SERVICE AND ARE NOT INTERESTED IN SERVICING MULTI-RESIDENTIAL BUILDINGS OF 20 OR MORE UNITS, PLEASE STOP HERE AND RETURN YOUR QUESTIONNAIRE IN THE POSTAGE PAID ENVELOPE PROVIDED.

Only those companies which presently service or are interested in servicing residential buildings of 20 or more units should complete the rest of this questionnaire. ALL REMAINING QUESTIONS DEAL WITH RESIDENTIAL STRUCTURES OF 20 OR MORE UNITS.

A8. Which of the following building systems do you service in residential buildings of 20 or more units?

☐ Space heating	☐ Automatic controls
☐ Space cooling	☐ Water treatment
☐ Ventilation	☐ Laundry room services
☐ Domestic hot water	☐ Pipe and duct insulation
☐ Building shell/envelope	☐ Plumbing
☐ Electrical	☐ Other mechanical services, please describe below:
☐ Other services, give brief description below:	

A9. Do you subcontract out any portion of your service work?

☐ Yes ☐ No

If yes, please specify _____

1x

Appendix 2

A10. What percentage of your business is:

- Service Work ___ %
- New Construction ___ %
- Upgrade or retrofit ___ %
- Other (specify below) ___ %

_____

TOTAL 100%

A11. For your service work, what percentage is:

- Maintenance Contract/ Parts Extra ___ %
- Time and Material ___ %
- One-Time Job or Quotation ___ %
- Other (specify below) ___ %

_____

TOTAL 100%

A12. How important are the following factors in residential equipment breakdown?

	Very Important	Important	Minor Importance	No Importance
– Poor Quality Equipment	☐	☐	☐	☐
– Poor Design and/or mis-application	☐	☐	☐	☐
– Improper Installation	☐	☐	☐	☐
– Improper Maintenance: inhouse staff	☐	☐	☐	☐
other service company	☐	☐	☐	☐
– Other (specify below):	☐	☐	☐	☐

_____

A13. What is your average response time on breakdown calls? ___ (hours)

A14. Do you offer 24 hour service to your customer? ☐ Yes ☐ No

A15. Estimate the % of your service business which comes from the following sources?

- Repeat business ___ %
- Referrals ___ %
- Direct sales ___ %
- Advertising ___ %
- Other (specify below) ___ %

_____

TOTAL 100%

PART B: Business Conditions

B1. How important are the following factors in the operation of your business?

	Very Important	Important	Minor Importance	No Importance
– Reputation	☐	☐	☐	☐
– Price	☐	☐	☐	☐
– Special services	☐	☐	☐	☐
– Fast response	☐	☐	☐	☐
– Other (specify below)	☐	☐	☐	☐

_____

B2. Which of the following co-ordination problems are common in your experience?

	Common Problem	Occasional Problem	Not A Problem	Not Applicable
– Building vs. Contract Staff	☐	☐	☐	☐
– Overlap of Trades in Service Work eg. mechanical vs. electrical	☐	☐	☐	☐
– Gap in Service - nobody to cover a specific area	☐	☐	☐	☐
– Communication with Client	☐	☐	☐	☐
– Communication with other trades	☐	☐	☐	☐
– Problem in time scheduling	☐	☐	☐	☐
– Other (specify below)	☐	☐	☐	☐

_____

B3. How would you rank the following problems in your service business:

	Serious Problem	A Problem	Occasional Problem	Not A Problem	Not Applicable
– Price Cutting	☐	☐	☐	☐	☐
– Call Backs	☐	☐	☐	☐	☐
– Hiring Good Staff	☐	☐	☐	☐	☐
– Training Staff	☐	☐	☐	☐	☐
– Uneven Work Load	☐	☐	☐	☐	☐
– Problem Clients	☐	☐	☐	☐	☐
– Unreasonable Expectations by clients	☐	☐	☐	☐	☐
– Other (specify below)					
_____	☐	☐	☐	☐	☐

PART C: Energy Related Service

C1. What percentage of the buildings you service have potential for cost-effective energy savings? |_|_|_| %

C2. What percentage of your work is directly related to energy conservation?

|_|_|_| %

C3. Do you actively propose or sell energy conservation measures to apartment building owners?

☐ Yes ☐ No

If yes, do you provide any of the following information?

	Not Applicable	Never	Sometimes	Always
– Capital Cost of Measure	☐	☐	☐	☐
– Estimated Energy Savings	☐	☐	☐	☐
– Simple Payback of measure	☐	☐	☐	☐
– Life Cycle Cost	☐	☐	☐	☐
– Recommend other Specialty Firm	☐	☐	☐	☐

C4. In general, how would you describe the building owners' attitude to energy conservation?

	True	Usually True	Usually Not True	Not True	Don't Know
• Owner doesn't care	☐	☐	☐	☐	☐
• Owner concerned:					
– has taken all necessary action	☐	☐	☐	☐	☐
– is upgrading building	☐	☐	☐	☐	☐
– makes poor decisions	☐	☐	☐	☐	☐
– does not want to spend money	☐	☐	☐	☐	☐
• Other (specify below)					
_____	☐	☐	☐	☐	☐

C5. Please list the most frequent energy-related upgrade measures you make in the course of your work.

1. _____
2. _____
3. _____
4. _____

PART D: Job Training and Qualifications

D1. Are there any trades for which you have difficulty finding fully trained service tradesmen?

☐ Yes ☐ No

If yes, what are they:

D2. How many of your workers have qualifications equivalent to:

– engineer |_|_|_| (number)
– technologist |_|_|_| (number)
– technician |_|_|_| (number)

7

B3. Are you satisfied with the technical education provided by the following institutions, as related to your company's field of work?

	Not Applicable	Very Satisfied	Generally Satisfied	Dis-Satisfied	Very Dis-Satisfied	Don't Know	
Universities	☐	☐	☐	☐	☐	☐	19 -
Community Colleges	☐	☐	☐	☐	☐	☐	20 -
Technical High Schools	☐	☐	☐	☐	☐	☐	21 -
Trade Associations	☐	☐	☐	☐	☐	☐	22 -
Manufacturer	☐	☐	☐	☐	☐	☐	23 -
Unions	☐	☐	☐	☐	☐	☐	24 -
Other (specify below)	☐	☐	☐	☐	☐	☐	25 - 26 -

_____

B4. Please describe any specific items which you feel need improvement in the area of educational programs.

_____ 27 - 28 - 29 -

_____

_____

_____

B5. If possible, please attach a list of existing certification programs, courses, seminars, or workshops which in your opinion provide useful training in your service sector.

Please return this questionnaire in the prepaid envelope provided.

Thank you

Appendix 3

TABLE A.3.1

MOST FREQUENTLY FOUND SYSTEMS TYPES

Question	System	%	Response
D1.1	Space Heating	65	central gas boiler
		25	individual electric baseboard
D2.1	Cooling	76	none
		12	individual window units
D3.1	Ventilation	48	central supply*
		29	central exhaust*
		27	individual exhaust*
D4.1	Domestic Hot Water	61	central gas boiler
		11	individual gas heater**
D5.1	Building Shell	49	brick
		47	concrete
D5.1	Glazing	51	double
		48	single
D6.1	Emergency Power	43	battery
		32	none
D6.1	Lighting Interior	63	incandescent*
		59	fluorescent*
D6.1	Lighting Exterior	80	incandescent*
		19	high intensity discharge*
D7.1	Automatic Controls	67	timeclocks (of returned questionnaires)*
		56	of heated ramps*
		52	of central boilers have indoor/outdoor control*
D8.1	Water Treatment	34	of central heating systems
D8.2	Laundry Room	96	having a laundry room
D8.3	Pipe & Duct Insulation	70	have pipe or duct insulation
D8.5	Air and Water Balancing	57	never
		19	every year
D8.6	Garage	57	neither heated garage or ramp heater
D8.7	Other Energy Consuming System	58	sauna (11 of 19 cases)

* many respondents checked more than one type. The number given is the total for this type, whether in combination with other types or not.

**followed closely by central electric and individual electric, each at 10%.

TABLE A.3.2

MOST FREQUENT UPGRADES

System	% Yes Upgraded*	Description	Count of Upgrade	Count of Respondents	Count of Descriptions
Space Heating	29			69	71
		Conversion to gas	14		
		New controls	14		
		New heating plant	13		
Cooling	--			4	4
		Heat pump	2		
Ventilation	10			21	22
		Time clocks	10		
		New motor/belts	7		
Domestic Hot Water	32			74	81
		"Total replacement"	38		
		Replaced/added hot water tanks	23		
Building Shell	33			79	94
		Caulk & weatherstrip	36		
		Roof repaired/replaced	22		
Electrical	23			48	54
		Improve lighting	34		
		Rewiring	6		
Automatic Controls	14			30	33
		New heating controls	18		
		Time clocks	6		
Pipe & Duct Insulation	16			26	27
		Domestic hot water system	25		
General Plumbing	34			65	79
		Conversion of galvanized to copper	29		
		General replace/ improvement	28		
Garage	12			16	18
		Structural repairs	8		
		Electrical	4		

*The questions about upgrades took the form of "Have any upgrades been made to the ..... system? If yes, what upgrades have been made and when?" Not all the respondents who checked "yes" gave a description of the upgrade. Some respondents described more than one upgrade.

TABLE A.3.3

FREQUENCY OF SERVICING

System	SCHEDULED MAINTENANCE									BREAKDOWN REPAIRS								
	Times per year						Serviced by:			Times per year						Serviced by:		
	3 and Over	2	1	0	(0) (as %)	Blank	Not Applic.	Not Serv'd.	Blank	3 and Over	2	1	0	(0) (as %)	Blank	Not Applic.	Not Serv'd.	Blank
Heating	58	65	67	20	(9.5)	55	38	6	49	80	44	45	34	(16.7)	62	30	1	62
Domestic Hot Water	42	46	83	36	(17.4)	58	11	3	40	34	43	56	55	(29.3)	77	3	1	47
Electricity	39	22	38	63	(38.9)	103	9	10	47	49	21	28	54	(35.5)	113	2	2	43
Building Shell	21	17	37	69	(47.9)	121	19	5	59	35	19	16	65	(48.1)	130	22	12	58
Plumbing	NA	NA	NA	NA	(NA)	NA	6	6	39	NA	NA	NA	NA	(NA)	NA	0	1	33

Sample Size: 265

NOTE: EVERY building has these systems.

TABLE A.3.4

SOURCE FOR SERVICE

System	Scheduled Maintenance		Breakdown Repairs	
	Outside Service Organization	Inhouse Staff	Outside Service Organization	Inhouse Staff
Space Heating	100	70	140	31
Cooling	36	14	38	10
Ventilation	85	85	113	57
Domestic Hot Water	136	73	178	35
Building Shell	101	71	140	41
Electrical	123	75	178	39
Water Treatment	41	37	41	26
Laundry Room Services	145	64	169	34
General Plumbing	115	99	173	58
Pipe & Duct Insulation	80	46	99	32
Air & Water Balancing	65	29	75	18
Automatic Controls	109	57	143	31
Garage	31	64	68	34